East Stanislaus Region

Integrated Regional Water Management Plan

DRAFT

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List of Abbreviations

AB	Assembly Bill
ACS	American Community Survey
AF	acre-feet
AFY	acre-feet per year
AWMC	Agricultural Water Management Council
AWMP	agricultural water management plan
B/C	benefit-cost ratio
BMO	basin management objective
BMP	best management practice
BNR	biological nutrient removal
CAAP	Climate Adaptation Advisory Panel
CalEPA	California Environmental Protection Agency
CARB	California Air Resources Board
CAS	climate adaptation strategy
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CAT	Climate Action Team
CCR	consumer confidence report
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CEDEN	California Environmental Data Exchange Network
CEQA	California Environmental Quality Act
CERES	California Environmental Resources Evaluation System
cfs	cubic feet per second
CII	commercial, industrial and institutional
CIMIS	California Irrigation Management Information System
CIP	capital improvement plan
CREAT	Climate Resilience Evaluation and Awareness Tool
CSD	community services district
CT	centroid timing
CVFPP	Central Valley Flood Protection Plan
CVP	Central Valley Project
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
CWC	California Water Code
CWP	California Water Plan
DAC	disadvantaged community
Delta	Sacramento-San Joaquin Delta
DER	Department of Environmental Resources
DFA	Dairy Farms of America
DMM	Demand Management Measure
DPWD	Del Puerto Water District
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
EID	Eastside Irrigation District
EIR	environmental impact report
EIS	environmental impact statement
EO	Executive Order
ESIRWM	East Stanislaus Integrated Regional Water Management
ESRWMP	East Stanislaus Regional Water Management Partnership

ET	evapotranspiration
EWMP	efficient water management practice
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GAMA	Groundwater Ambient Monitoring and Assessment Program
GCM	global climate models
GHG	greenhouse gas
GIS	geographic information system
gpcd	gallons per capita per day
gpm	gallons per minute
GWMP	groundwater management plan
HCP	habitat conservation plan
ICM	initial conceptual model
IPCC	Intergovernmental Panel on Climate Change
IRWM	integrated regional water management
IRWMP	integrated regional water management plan
JPA	joint powers authority
LAFCo	Local Agency Formation Commission
LFD	low flow deviation
LID	low impact development
MAF	mean annual flow
M&I	municipal and industrial
MDWP	Modesto Domestic Water Project
MG	million gallons
mgd	million gallons per day
MHI	median household income
MID	Modesto Irrigation District
mL	milliliter
MOU	memorandum of understanding
MPO	metropolitan planning organization
MRWTP	Modesto Regional Water Treatment Plan
MSR	small municipal storm sewer system
MSR	municipal service review
MW	megawatt
NEPA	National Environmental Protection Act
NPDES	National Pollution Discharge Elimination System
NPS	Non-point source
NVRRWP	North Valley Regional Recycled Water Project
O&M	operations and maintenance
QA/QC	quality assurance and quality control
OCAP	operations criteria and planning
OID	Oakdale Irrigation District
OPR	Office of Planning and Research
PG&E	Pacific Gas and Electric Company
PAC	Public Advisory Committee
ppm	parts per million
PRC	Public Resources Code
Prop	proposition
RAP	Regional Acceptance Process
RD	reclamation district

RM	river mile
RMS	resource management strategy
RSWSP	Regional Surface Water Supply Project
RTP	ready to proceed
RWMG	regional water management group
RWQCB	Regional Water Quality Control Board
RWQCF	Turlock Regional Water Quality Control Facility
SB	Senate Bill
SC	Steering Committee
SCADA	supervisory control and data acquisition
SWRCB	State Water Resources Control Board
SDMP	storm drain master plan
SJRNWR	San Joaquin River National Wildlife Refuge
SNMP	salt and nutrient management plan
SOI	sphere of influence
SRF	State Revolving Fund
SRWA	Stanislaus Regional Water Authority
SSJID	South San Joaquin Irrigation District
StanCOG	Stanislaus Council of Governments
STRGBA	Stanislaus and Tuolumne Rivers Groundwater Basin Association
SWAMP	Surface Water Ambient Monitoring Program
SWMP	storm water management plan
SWP	State Water Project
TDS	Total Dissolved Solids
TGBA	Turlock Groundwater Basin Association
TID	Turlock Irrigation District
TMDL	Total Maximum Daily Load
UC	University of California
USBR	U.S. Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWMP	urban water management plans
WAS	waste activated sludge
WDL	Water Data Library
WEAP	Water Evaluation And Planning Model
WMI	water management initiative
WSMP	water supply master plan
WWTP	wastewater treatment plant

Chapter 1 Introduction

1.1 IRWMP Overview

In 2002, the Integrated Regional Water Management Act was created when Senate Bill 1672 was passed. The purpose of the Act was to encourage local agencies to coordinate and collaboratively manage water resources to improve water quality, quantity and reliability. Following creation of the Act, in November 2002, the voters of the State of California recognized and codified the need for integrated regional planning for the management of water resources with the passage of Proposition (Prop) 50, *the Water Security, Clean Drinking Water, Coastal and Beach Protection Act*. Central to Prop 50 was the preparation of Integrated Regional Water Management Plans (IRWMPs). IRWMPs define planning regions and identify strategies that allow for the regional management of water resources in what began as four main areas: water supply, groundwater management, ecosystem restoration, and water quality. Prop 50 provided $500 million to fund competitive grants for preparing IRWMPs and for implementing projects that were consistent with IRWMPs. Since its inception, the IRWM program has evolved. In November 2006, California voters passed Prop 84, *the Safe Drinking Water, Water Quality, and Supply, Flood Control, River and Coastal Protection Bond Act*, providing $1 billion for planning and implementation grant funding through the IRWM program. Prop 1E, referred to as *the Disaster Preparedness and Flood Prevention Bond Act*, was also passed at that time, providing $300 million for IRWM Stormwater Flood Management. The California Department of Water Resources (DWR) administers the IRWM grant programs as currently funded by Props 50, 84, and 1E. As part of that program administration, DWR released the *Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines* (Guidelines) in November 2012, a set of guidelines for IRWM implementation and planning grants, including descriptions of what must be included in an IRWMP to be eligible for the grant program.

The IRWMP is intended to be a living plan that is to be updated regularly. The Plan summarizes regional goals and objectives for water resources management, and identifies strategies, projects, and programs intended to fulfill those goals and objectives. Projects and programs included in the IRWMP are designed to integrate multiple resource management strategies (RMSs) and projects to provide multiple-benefit solutions and beneficiaries, both locally and regionally. Program Preferences are developed as part of the IRWM Program, equating to a number of criteria that IRWMPs and associated grant proposals should address. The Program Preferences, as included in the Prop 84 Guidelines, are to:

- Include regional projects or programs
- Effectively integrate water management programs and projects within a hydrologic region identified in the California Water Plan; the Regional Water Quality Control Board (RWQCB) region or subdivision; or other region or sub-region specifically identified by DWR
- Effectively resolve significant water-related conflicts within or between regions
- Contribute to attainment of one or more of the objectives of the CALFED Bay-Delta Program
- Address critical water supply or water quality needs of disadvantaged communities within the region
- Effectively integrate water management with land use planning
- To provide for non-State funded flood control or flood prevention projects (pursuant to PRC §5096.824 or §75034) to provide multiple benefits, including, but not limited to, water quality improvements, ecosystem benefits, reduction of in-stream erosion and sedimentation, and groundwater recharge.
- Address Statewide priorities [for water resource management] which include:

- Drought Preparedness
- Use and Reuse Water More Efficiently
- Climate Change Response Actions
- Expand Environmental Stewardship
- Practice Integrated Flood Management
- Protect Surface Water and Groundwater Quality
- Improve Tribal Water and Natural Resources
- Ensure Equitable Distribution of Benefits

This IRWMP has been prepared for the East Stanislaus IRWM (ESIRWM) region. It is consistent with the Prop 84 Guidelines, the priorities and objectives for regional planning, and reflects local resources and environment.

1.2 Regional Water Management Group

The East Stanislaus Regional Water Management Partnership (ESRWMP), the official Regional Water Management Group for the region, is presently comprised of the Cities of Modesto, Hughson, Ceres and Turlock. According to California Water Code (CWC) §10539, a Regional Water Management Group (RWMG) is a "group in which three or more local agencies, at least two of which have statutory authority over water supply or water management, as well as those other persons who may be necessary for the development and implementation of a plan that meets the requirements of CWC §10540 and §10541, participate by means of a joint powers agreement, Memorandum of Understanding (MOU), or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies." For the ESIRWM region, all four entities have statutory authority over water supply or management in their respective jurisdictions, and all ESRWMP members signed an MOU dated August 23, 2011 (included in Appendix A) which formally formed the ESRWMP.

The ESRWMP initiated development of the East Stanislaus Region and spearheaded completion of the Region Acceptance Process (RAP) application to become an official IRWM region. This Region, and its associated RWMG, are relatively new and were recently developed, beginning in July 2010, to foster regional communication and cooperation and to cooperatively resolve potential water supply conflicts in the Region.

1.3 IRWMP Development

The State of California has established IRWM Plan Standards or Guidelines that define aspects that must be addressed in each IRWMP. This IRWMP has been constructed to meet or surpass each of those standards. The organization of the Plan is such that each Plan Standard is documented and addressed. The Plan Standards include documentation of:

> "IRWM Plan Standards are used to describe what must be in an IRWM Plan and can be used as criteria in Implementation Grant applications."
>
> - *Proposition 84 & 1E IRWM Guidelines*, November 2012, Page 18

- *Governance* – The governance structure for a region's IRWMP development and implementation. A description of the Regional Water Management Group responsible for development and implementation of the Plan and the project proponents who will adopt the Plan.
- *Region Description* – The watersheds and water systems within the Region; internal boundaries; and water supplies and demands, including

potential effects of climate change. Comparison of current and future water quality conditions in the Region. Description of social and cultural makeup of the regional community. Description of major water related objectives and conflicts. Explanation of how the IRWM regional boundary was determined and why it is appropriate. Identification of neighboring and/or overlapping IRWM efforts and explanation of planned/working relationships.

- *Objectives* – Objectives of the IRWMP that are measurable, and the process used to develop them. Explanation of prioritization of objectives if they are prioritized or the reasons they are not prioritized.
- *Resource Management Strategies* – Resource management strategies considered to meet IRWM objectives and which strategies were incorporated into the Plan. Effects of climate change on the region's water resources.
- *Integration* – Structures and processes that provide opportunities to develop and foster integration.
- *Project Review Process* – Procedures for submitting a project to the RWMG. Procedures for review of projects considered for inclusion into the Plan. Displaying the lists of selected projects.
- *Impact and Benefit* – Discussion of potential impacts and benefits of implementation of the IRWMP.
- *Plan Performance and Monitoring* – Performance measures and monitoring methods to ensure the objectives of the IRWMP are met.
- *Data Management* – Process of data collection, storage, and dissemination to IRWM participants, stakeholders, public, and the State.
- *Finance* – Possible funding sources, programs, and grant opportunities for the development & ongoing funding of the IRWMP. Funding mechanisms (e.g. rate structures) for projects that implement the IRWMP. Explanation of the certainty and longevity of known or potential funding for the IRWMP and projects included. Explanation of how O&M costs for projects would be covered.
- *Technical Analysis* – Data and technical analyses that were used in the development of the IRWMP.
- *Relation to Local Water Planning* – A list of local water plans used in the IRWMP. Discussion of how the IRWMP related to planning documents and programs established by local agencies. Description of the dynamics between the IRWMP and local planning documents.
- *Relation to Local Land Use Planning* – Current relationship between local land use planning, regional water issues, and water management objectives. Future plans to further a collaborative, proactive relationship between land use planners and water managers.
- *Stakeholder Involvement* – Description of the public process that provides outreach and an opportunity to participate in the IRWMP development and implementation. Process used to identify, inform, invite and involve stakeholder groups in the IRWM process. Discussion of how the RWMG will endeavor to involve DACs and Native American trivial communities in the IRWM planning effort. Description of the decision making process. Discussion regarding how stakeholders are necessary to address the objectives and resource management strategies. Discussion of how collaborative processes will engage a balance of the interest groups regardless of their ability to contribute financially to the IRWMP's development or implementation.

- *Coordination* – Identification of the process to coordinate water management projects and activities of participating local agencies and stakeholders to avoid conflicts and take advantage of efficiencies. Identification of neighboring IRWM efforts and how cooperation/coordination with these efforts will be accomplished. Identification of areas where a State agency may be able to assist in communication, cooperation, or implementation of IRWMP components, processes, projects, etc.
- *Climate Change* – Discussion of the potential effects of climate change on the IRWM region, including an evaluation of the IRWM region's vulnerabilities to the effects of climate change and potential adaptation responses. Process that discloses and considers greenhouse gas emissions when choosing between project alternatives.

As described in the Guidelines, although the Plan Standards name specific topics the IRWMP should cover, they do not constitute an outline for the Plan. The following table shows which sections of the IRWMP address the Plan Standards previously described. All of the Plan Standards are addressed which helps ensure the creation of a high quality, implementable IRWMP.

Table 1-1: Plan Standards Addressed in the East Stanislaus IRWMP

Plan Standard	East Stanislaus IRWMP Chapter to Reference
Governance	3.1, 3.2
Region Description	2.1, 2.2, 2.3
Objectives	4.1, 4.2, 4.3, 4.5
Resource Management Strategies	4.4
Integration	5.2
Project Review Process	5.1, 5.2, 5.3
Impacts and Benefits	5.4
Plan Performance and Monitoring	7.1, 7.3, 7.4
Data Management	6.2
Finance	7.2
Technical Analysis	6.1
Relation to Local Water Planning	4.7, 4.8
Relation to Local Land Use Planning	4.9
Stakeholder Involvement	3.2
Coordination	3.3, 3.4
Climate Change	2.3, 5.2

Ongoing information about the development and implementation of this IRWMP can be found on the East Stanislaus IRWM Region's website at www.eaststanirwm.org.

1.4 IRWMP Adoption

ESRWMP member agencies and project proponents are expected to adopt the IRWMP upon completion, and any stakeholder entities can choose to accept or adopt the completed Plan to demonstrate support and commitment to implementation. Upon completion of the East Stanislaus IRWMP, the following entities adopted this Plan:

- [ADD ENTITIES WHO ADOPT PLAN AND DATE OF ADOPTION]

As described in Chapter 7.4, Plan Updates, the East Stanislaus IRWMP will be updated periodically to reflect changing conditions and IRWMP project implementation. When the IRWMP is updated, it will be re-adopted by the participating agencies. There may, however, be interim changes to the IRWMP that will be administrative in nature; for example, the project list may be updated prior to a grant proposal solicitation. This IRWMP does not require re-adoption of this Plan for interim or administrative changes.

Chapter 2 ESIRWM Region

2.1 Region Description

An IRWMP must include a description of the region being managed by the RWMG. This section should describe:

- Watersheds and water systems within the region.
- Internal boundaries within the region.
- Water supplies and demands for a minimum of a 20-year planning horizon.
- Current and future water quality condition in the region.
- Social and cultural makeup of the regional community.
- Major water related objectives and conflicts (in Section 4.1 of this Plan).
- An explanation of how the IRWM regional boundary was determined.
- Neighboring and/or overlapping IRWM efforts.

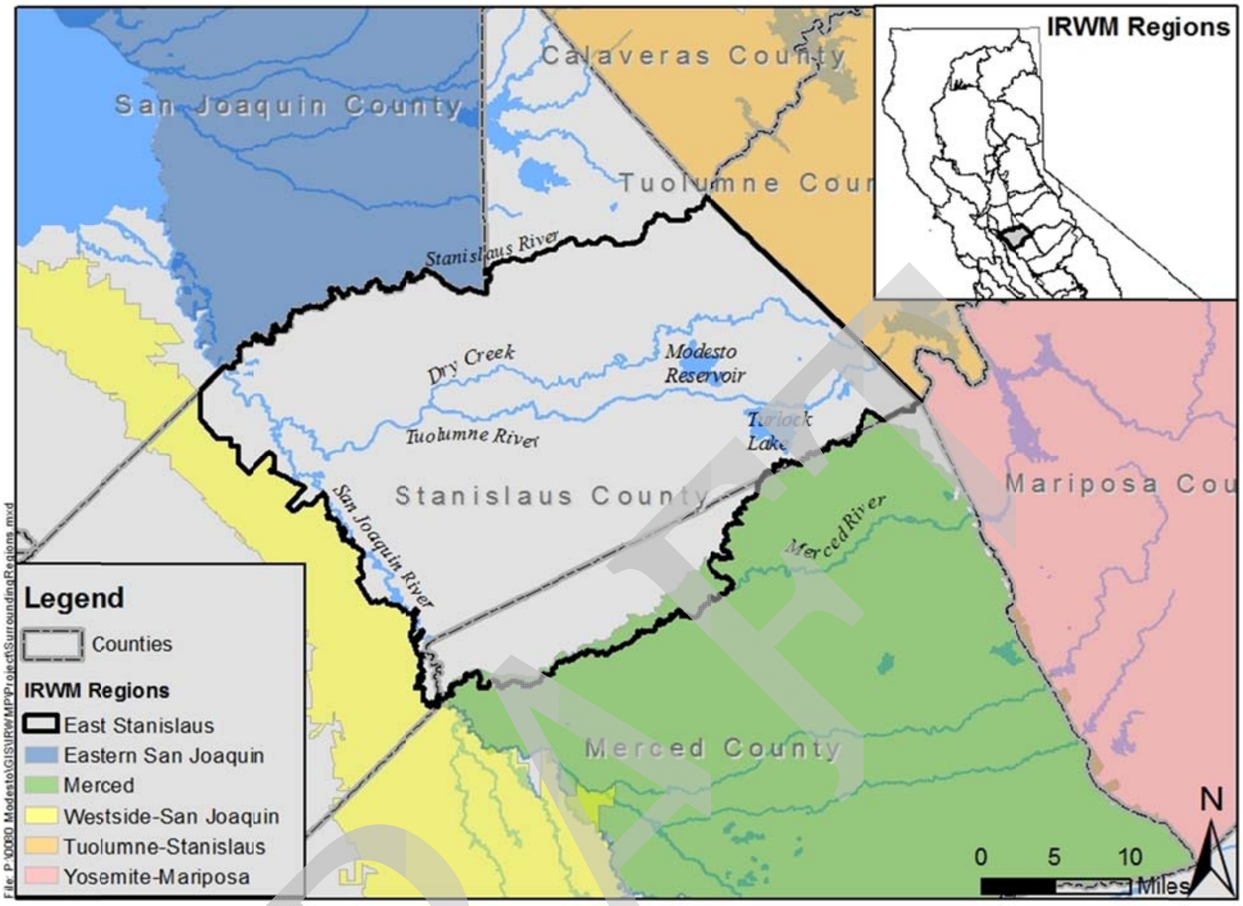
- *Proposition 84 & 1E IRWM Guidelines*, November 2012, Pages 19 to 20

2.1.1 Region Boundaries

The need for integrated regional planning in Stanislaus County, and therefore the need for an Integrated Regional Water Management (IRWM) region, is most easily noted visually when viewing DWR's 2010 IRWM Regional Map. At the time, there was a void in IRWM coverage over the Cities of Modesto, Hughson, Turlock, and Ceres, in between the following five IRWM regions: Central California (now referred to as Yosemite-Mariposa), Merced, Eastern San Joaquin, Tuolumne-Stanislaus and Westside-San Joaquin. As with other areas of the Central Valley, water resource conflicts are present as agricultural and urban demands collide, groundwater and surface water resources become impacted, and as the region continues to grow. In response to this current environment, the East Stanislaus Regional Water Management Partnership (ESRWMP) was formed and the East Stanislaus IRWM Region developed, as shown in Figure 2-1, in an effort to create a regional management solution for long-term water resources management.

The East Stanislaus IRWM Region has common boundaries with the Merced, Eastern San Joaquin, Tuolumne-Stanislaus and Westside-San Joaquin IRWM regions, and with some local agency and environmental boundaries. By using the boundaries of neighboring IRWM regions as a starting point, the East Stanislaus Region was formulated to cover an area of California that lacked integrated regional water planning and to avoid major overlaps with neighboring IRWM regions.

Figure 2-1: Boundaries of the East Stanislaus Region



The boundaries of the East Stanislaus IRWM Region result from a combination of IRWM and local jurisdictional boundaries and geographical and environmental considerations, and are as follows:

North Boundary: The north boundary of the East Stanislaus Region is defined by the Stanislaus River, Modesto Groundwater Subbasin, and also a portion of the Stanislaus County border. The boundary also aligns with the Eastern San Joaquin IRWM boundary. Importance was placed on natural water boundaries and not solely political or jurisdictional boundaries. This resulted in the exclusion of north-eastern portion of Stanislaus County. This area was not chosen to be part of the region because it cannot be justified from a watershed perspective. However, the communities in this area are invited to participate in the East Stanislaus Region.

South Boundary: The Merced River, the Turlock Groundwater Subbasin, and the Turlock Irrigation District (TID) boundaries were used to delineate the southern boundary of the East Stanislaus IRWM Region. The southern boundary of the Region is located within the Merced IRWM Region and creates a small overlap. The two IRWM regions have been coordinating during the plan development process and have discussed the overlap during development of each region's boundaries. At present, it has been agreed that each region will address its entire region in the planning process, and as such, the East Stanislaus Region is including its entire region, including the overlap area in the planning efforts currently underway. Should a project be identified in the overlap area or a need arise that further coordination with the Merced Region be required, the

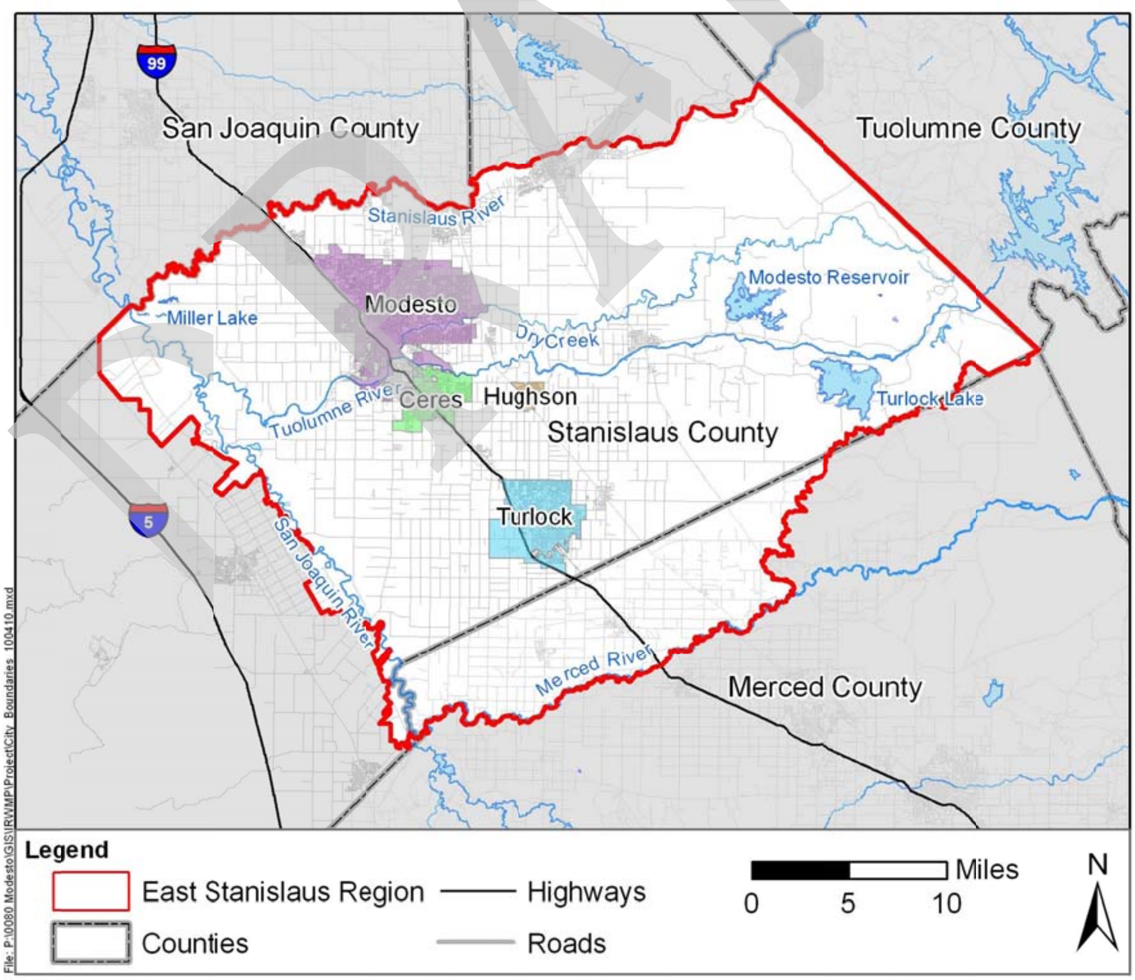
ESRWMP will do so accordingly. Both IRWM regions recognize coordination in this area is required and both are willing to cooperate.

Eastern Boundary: The existing Tuolumne-Stanislaus IRWM Region boundary was used to form the eastern boundary of the East Stanislaus Region. By aligning the region boundary with the neighboring IRWM region's boundary, unnecessary confusion is avoided and inter-regional water management strategies can still be employed. The location of the eastern boundary also ensures that the Turlock and Modesto Groundwater Subbasins are located within the East Stanislaus Region.

Western Boundary: The San Joaquin River and the Westside-San Joaquin IRWM Region boundaries were used for the western boundary of the East Stanislaus region. The western boundary of both the Turlock and Modesto Groundwater Subbasins is the San Joaquin River; therefore the East Stanislaus Region fully encompasses these groundwater subbasins.

The East Stanislaus Region incorporates portions of both Stanislaus and Merced counties. The major cities located within the Region are the Cities of Modesto, Hughson, Turlock, and Ceres, which also comprise the ESRWMP (Figure 2-2); however, all cities within Stanislaus and Merced Counties, as well as neighboring counties, have been, and will continue to be, invited to participate in the IRWM process. The entire East Stanislaus Region is located within Central Valley Regional Water Quality Control Board's jurisdiction.

Figure 2-2: Major Cities Located in the East Stanislaus Region



2.1.2 Climate

The East Stanislaus Region has a Mediterranean climate with hot, dry summers and cool winters, with most of the annual precipitation occurring between November and April. The average annual maximum temperature is 74.6 degrees Fahrenheit (°F), as shown in the following table, but it is not uncommon for summer temperatures to exceed 100°F. Extreme winter lows can reach the teens with the first freeze usually in December and the last in February.

Table 2-1: Average Temperatures and ETo in the East Stanislaus Region

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly Average ETo (in)[a]	0.87	1.71	3.43	5.24	6.70	7.40	7.85	6.75	4.93	3.37	1.66	0.87	50.78
Average Total Precipitation (in)[b]	2.47	2.08	1.91	1.03	0.46	0.12	0.02	0.04	0.18	0.63	1.23	2.06	12.22
Average Max Temperature (°F)[b]	53.8	60.9	67.0	73.3	81.2	88.4	94.3	92.2	87.6	77.9	64.6	54.3	74.6
Average Min Temperature[b]	37.6	40.8	43.5	46.8	51.8	56.6	59.9	58.8	55.9	49.5	41.7	37.7	48.4

a. Data from California Irrigation Management Information System (CIMIS) Station#71.
b. Data from Western Regional Climate Center for Modesto, CA. Period of record is March 1, 1906 to July 31, 2010.

2.1.3 Watersheds and Water Systems

Watersheds

Within the Central Valley, three major watersheds were delineated – the Sacramento River Basin, the San Joaquin River Basin, and the Tulare Lake Basin. The East Stanislaus Region is within the San Joaquin River Basin, which is bound by the crest of the Sierra Nevada on the east and the Klamath Mountains on the west. The San Joaquin River Basin covers about 15,880 square miles and includes the San Joaquin River and its larger tributaries – the Cosumnes, Mokelumne, Calaveras Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. The San Joaquin River Basin can be further divided into other watersheds and sub-watersheds (CVRWQCB, 2004). The Merced, Stanislaus and Tuolumne River watersheds are three watersheds within the San Joaquin River Basin and these are the primary surface water watersheds that drain to the Middle San Joaquin-Lower Merced-Lower Stanislaus Watershed in which the East Stanislaus region is almost entirely located (Figure 2-3). The Merced, Tuolumne, and Merced Rivers are approximately 145, 149, and 96 miles long, respectively. Table 2-2 summarizes the key characteristics of the four rivers in the East Stanislaus Region.

Figure 2-3: Watersheds Within and Around the East Stanislaus Region

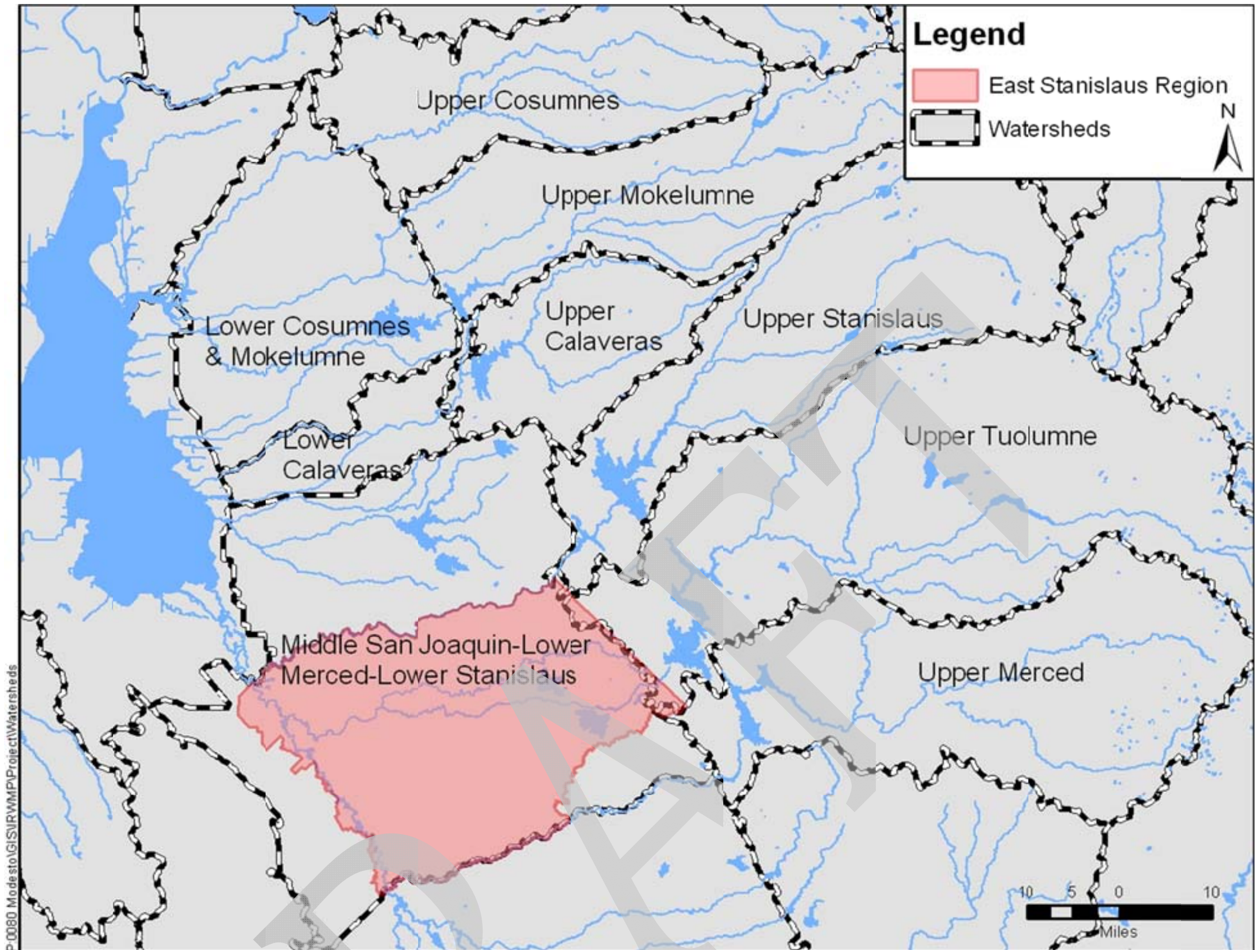


Table 2-2: Watershed and Reservoir Characteristics in the San Joaquin River Basin

Characteristic	Lower San Joaquin River: Stanislaus River	Lower San Joaquin River: Tuolumne River	Lower San Joaquin River: Merced River	Upper San Joaquin River
Median Annual Unimpaired Flow (1923-2008)	1.08 MAF	1.72 MAF	0.85 MAF	1.44 MAF (upstream of Friant Dam)
Drainage Area of Tributary at Confluence with San Joaquin (and percent of tributary upstream of mouth)[1]	1.195 square miles (82% upstream of Goodwin)	1.870 square miles (82% upstream of LaGrange)	1.270 square miles (84% upstream of Merced Falls)	1.675 square miles (100% upstream of Friant Dam)
Total River Length	161 miles	155 miles	135 miles	330 miles
Miles Downstream of Major Dam	New Melones: 62 miles Goodwin: 59 miles	New Don Pedro: 55 miles LaGrange: 52 miles	New Exchequer: 63 miles Crocker-Huffman: 52 miles	Friant: 266 miles
Confluence with LSJR River Miles (RM) Upstream of Sacramento River Confluence	RM 75	RM 83	RM 118	RM 266
Number of Dams	28 DSOD[a]	27 DSOD	8 DSOD	19 DSOD
Total Reservoir Storage	2.85 MAF	2.94 MAF	1.04 MAF	1.15 MAF
Most Downstream Dam (with year built and capacity)	Goodwin, 59 miles upstream of SJR (1912, 500 AF)	LaGrange, 52 miles upstream of LSJR (1893, 500 AF)	Crocker-Huffman, 52 miles upstream of LSJR (1910, 200 AF)	Friant, 260 miles upstream of the Merced confluence (1942, 520 TAF)
Major Downstream Dams (with year built and reservoir capacity)	New Melones (1978, 2.4 MAF) Tulloch, Beardsley, Donnells "Tri-dams project" (1958, 203 TAF)	New Don Pedro (1971, 2.03 MAF)	New Exchequer (1967, 1.02 MAF) McSwain (1966, 9.7 TAF)	Friant (1942, 520 TAF)
Major Upstream Dams (with year built and reservoir capacity)	New Spicer Meadows (1988, 189 TAF)	Hetch Hetchy (1923, 360 TAF) Cherry Valley (1956, 273 TAF)	None	Shaver Lake (1927, 135 TAF) Thomas Edison Lake (1965, 125 TAF) Mammoth Pool (1960, 123 TAF)

Source: *Evaluation of San Joaquin River Flow and Southern Delta Water Quality Objectives and Implementation*, ICF, December 2012.
a. DSOD dams are those greater than 50 ft. in height and/or greater than 50 AF in capacity, with some exceptions.
MAF – million acre-feet
RM – river mile
DSOD – Division of Safety of Dams
AF – acre-feet
TAF – thousand acre-feet

San Joaquin River

The San Joaquin River Basin covers approximately 32,000 square miles in the northern part of the San Joaquin Valley, roughly from Fresno to Stockton (San Joaquin River Group Authority, 1999). The San Joaquin River is 330 miles in length, from its headwaters to its confluence with the Sacramento River. The portion of the river in the East Stanislaus Region is located north along the western edge of the Region. The primary sources of surface water to the basin are rivers that drain the western slope of the Sierra Nevada Range. Each of these rivers (the San Joaquin, Merced, Tuolumne, Stanislaus, Calaveras, Mokelumne and Cosumnes Rivers) drains large areas of high elevation watershed that supply snowmelt runoff during the late spring and early summer months. Historically, peak flows occurred in May and June, and flooding occurred in most years along all the major rivers. However, construction and operation of the numerous water supply, hydroelectric, and flood control efforts during the 20th century have modified the historic flows (San Joaquin River Group Authority, 1999).

The Lower San Joaquin River is defined as the river's confluence with the Merced River, north to the Delta. This stretch of the river is characterized by the combination of flows from tributary streams, major rivers, groundwater accretions and agricultural drainage water (San Joaquin River Group Authority, 1999).

Overall, the San Joaquin River is the second longest river in California, and habitats along the river have been heavily affected by the river's control upstream at Friant Dam and by adjacent land uses. One primary river habitat within the East Stanislaus Region is the San Joaquin River National Wildlife Refuge (SJRNWR). The Refuge is located west of Modesto, within the historic floodplain of the confluences of the San Joaquin, Stanislaus, and Tuolumne Rivers. The Refuge was established in 1987 because of the importance of the area as habitat for the Aleutian Canada goose. Refuge lands consist of oak-cottonwood-willow riparian forest, pastures, agricultural fields, and wetlands, with habitats for a diversity of wildlife including numerous special species such as Swainson's hawks, herons and cormorants, and the endangered riparian brush rabbits. The Refuge presently encompasses more than 6,500 acres; expansion of the refuge is currently consideration with expansions to the north, south and east along the San Joaquin River, Stanislaus River and Tuolumne River corridors.

In December 2012, the SWRCB issued a Draft Substitute Environmental Document (SED) in Support of Potential Changes to the Water Quality Control Plan for the Bay-Delta: San Joaquin River Flows and Southern Delta Water Quality. The preferred alternative identified in the SED called for 35 percent unimpaired flows from February through June within the Merced, Tuolumne and Stanislaus Rivers to support spring fish populations. This proposed action has the potential to significantly change water management on all three rivers, restricting water purveyors' ability to divert surface water and conjunctively manage the rivers and their underlying groundwater subbasins. Additionally, the proposed action has the potential to negatively impact fall-run Chinook as the changes will likely lead to increased temperatures of releases from reservoirs

Stanislaus River

The Stanislaus River watershed is approximately 578,000 acres, located in the central Sierra Nevada, and is one of the largest tributaries to the San Joaquin River in the Central Valley. Snowmelt runoff contributes the largest portion of the flows in the Stanislaus River, with the highest monthly flows in May and June (San Joaquin River Group Authority, 1999). Within the Stanislaus River watershed, there are 18 dams and 10 powerhouses. The lower Stanislaus River also has 16 parks or river access areas. There are 11 riverside parks between Knight's Ferry and the confluence with the San Joaquin River that are managed by the U.S. Army Corps of Engineers. The parks provide camping, fishing, and boating access to the River. The Stanislaus River at Highway 99 and downstream includes Caswell Memorial State Park, as well as smaller parks such as Modesto's Oak Grove Park. The Army Corps of Engineers developed a plan for a series of access parks along the Stanislaus River called the "String of Pearls" (ESA, 2013).

Flow control in the lower Stanislaus River is provided by the New Melones Reservoir, which has a capacity of 2.4 million acre-feet (AF) and is operated by the Bureau of Reclamation (USBR). Releases from New Melones Reservoir are re-regulated downstream at Tulloch Reservoir. The main water diversion point on the Stanislaus River is Goodwin Dam, which provides deliveries to Oakdale Irrigation District and the South San Joaquin Irrigation District in San Joaquin County. Goodwin Dam is also used to divert water into the Goodwin Tunnel for deliveries to Central San Joaquin Water Conservation District and the Stockton East Water District, also in San Joaquin County (San Joaquin River Group Authority, 1999).

The major habitat type along the lower Stanislaus River is valley foothill riparian, primarily bordering the river. This habitat is characterized by a canopy layer of cottonwoods, California sycamores and valley oaks. Annual grassland is also found in this area, within reach of the river. This habitat is characterized as an open habitat dominated by annual grasses. The California Department of Fish and Wildlife conducted surveys along 59 miles of the Stanislaus River from the confluence with San Joaquin River upstream to Goodwin Dam. Some of the identified species of concern in the watershed include fall-run Chinook salmon (species of concern), steelhead trout (threatened), California tiger salamander, California red-legged frog, riparian brush rabbit, and riparian woodrat (California Department of Fish and Wildlife, 1995).

Tuolumne River

The headwaters of the Tuolumne River begin in Yosemite National Park in the Sierra Nevada at an elevation of about 13,000 feet. The Tuolumne River's two primary sources begin on Mount Dana and Mount Lyell, the tallest peak in the Park. The Dana and Lyell tributaries meet at the eastern edge of Tuolumne Meadows forming the Tuolumne River. From Tuolumne Meadows, the river descends 4,000 feet to the Hetch Hetchy Reservoir. Other creeks also enter Hetch Hetchy Reservoir, including Return, Paiute, Rancheria, and Falls Creeks above the O'Shaughnessy Dam. At the dam, approximately 33% of the river's flow is diverted through Canyon Tunnel, and ultimately to the San Francisco Bay Area, where it provides water to nearly 2.5 million people. Below O'Shaughnessy Dam, the Tuolumne River exits Yosemite National Park and enters the Stanislaus National Forest. Between Kirkwood Powerhouse and Don Pedro Reservoir, the Tuolumne River is known for its world-class whitewater rapids for recreation. The various reaches of the Tuolumne River are described below:

- The Middle Tuolumne River begins at an elevation between 7,000 and 8,000 feet inside Yosemite National Park and joins the South Fork of the Tuolumne River outside the Park.
- The South Fork of the Tuolumne River's headwaters is between White Wolf and Yosemite Valley, at an elevation of about 8,000 feet. The South Fork exits the park slightly north of Hodgdon Meadow and upstream of its confluence with the main Tuolumne River.
- The North Fork of the Tuolumne River begins near Dodge Ridge, south of Highway 108 in Stanislaus National Forest. It joins the Tuolumne River above Don Pedro Reservoir.
- Dry Creek is the largest tributary to the Tuolumne River, beginning north of La Grange and entering Tuolumne River in the City of Modesto.

Flows in the lower portion of the Tuolumne River are controlled primarily by the operation of New Don Pedro Dam, which was constructed in 1971 jointly by TID and MID with participation by the City and County of San Francisco. The 2.03 million AF reservoir stores water for irrigation, hydroelectric generation, fish and wildlife enhancement, recreation, and flood control purposes.

The districts divert water to the Modesto Main Canal and the TID Main Canal a short distance downstream from New Don Pedro Dam at La Grange Dam (San Joaquin River Group Authority, 1999).

The Tuolumne watershed has an area of approximately 980,000 acres and provides wildlife habitat supporting many species of wildlife, including bald eagles, spotted owls, prairie falcons, and trout. The lower Tuolumne River is a site to which thousands of Chinook salmon return every fall to spawn. Within the Tuolumne River itself, a diverse assortment of animals seek food, water and shelter, including many special-status species. Some of these species include fall-run Chinook salmon (species of concern), steelhead trout (threatened), Riparian Brush Rabbit (endangered), Riparian Wood Rat (endangered), Valley Elderberry Longhorn Beetle (threatened), Least Bell's Vireo (threatened), and Swainson's Hawk (species of concern) (Tuolumne River Trust, 2009).

The Tuolumne River Regional Park (TRRP), near Highway 99 and the cities of Modesto and Ceres, is being developed by the two cities and Stanislaus County. It is being developed on 500 acres of public land along seven miles of the Tuolumne River in a series of separate parks. Upon completion, it will include 150 acres of park lands, pedestrians/bike trails, and over 350 acres of land designated for riparian habitat conservation and restoration. Five of the parks have been fully or partially developed to date, and one more will be completed in the future. Other river-oriented County parks are also located along the Tuolumne River (e.g. Riverdale Park). The Tuolumne River Trust has an active Lower Tuolumne River Parkway initiative, working with a larger coalition of interests to accomplish an array of goals (ESA, 2013).

Merced River

The Merced River watershed is also located in the central Sierra Nevada with its upper reaches in Yosemite National park. The watershed encompasses about 663,000 acres from its headwaters near Triple Divide Peak to a major hydroelectric project at the New Exchequer Dam that impounds 1 million AF at Lake McClure. Releases from Lake McClure pass through a series of power plants and small diversions, and are re-regulated at McSwain Reservoir. Below McSwain Dam, water is diverted to Merced Irrigation District at the Pacific Gas and Electric Company (PG&E) Merced Falls Dam and further downstream at the Crocker Huffman Dam (San Joaquin River Group Authority, 1999).

A large portion of the Merced River watershed lies within Yosemite National Park, while another large portion falls under National Forests and Bureau of Land Management jurisdiction. Much of the watershed is considered alpine climate; the upper portion receives heavy snowfall during winter months which is usually enough to feed the Merced River and its tributaries the remainder of the year. The middle and lower portions of the watershed are considered to have Mediterranean or semi-desert climates. Like the Tuolumne River, the Merced River provides habitat to many wildlife species. A study was conducted in 2006 which identified 37 species of fish, 127 bird species, and 140 insect and invertebrate species within the Merced River watershed. Of the 37 species of fish, 26 species were found in the lower Central Valley portion of the river. The Chinook salmon, Pacific lamprey, and striped bass are three anadromous fish species found in the lower Merced River.

Water Systems

The interior of the East Stanislaus Region includes Dry Creek, the Merced, San Joaquin, Stanislaus, and Tuolumne Rivers, as well as Modesto Reservoir and Turlock Lake. The Region overlies the San Joaquin Valley Groundwater Basin, which is divided into nine subbasins including the Turlock, Modesto and Delta-Mendota Subbasins. The Region overlies the entire Turlock and Modesto

Groundwater Subbasins, as shown in Figure 2-4, and also includes a portion of the Delta-Mendota Groundwater Subbasin. Percolation of water used for irrigation on lands overlying the groundwater subbasins is the largest inflow to the groundwater subbasins and provides an important role in maintaining groundwater storage and sustaining recharge. Additional information about the Turlock and Modesto Groundwater Subbasins is included in Section 2.2.1, below.

The East Stanislaus Region encompasses the service areas of multiple local agencies and maximizes opportunities for integrated water management activities. The four ESRWMP members have jurisdiction over water supply and quality, wastewater, recycled water, stormwater, and watershed/habitat in their respective service areas. The other entities that have water management responsibilities within the Region include other cities and communities, irrigation and water districts, and Stanislaus and Merced Counties. Other (non-ESRWMP) local agencies within the Region include:

- City of Riverbank
- City of Waterford
- City of Oakdale
- Keyes Community Services District
- Denair Community Services District
- Community of Del Rio
- Community of Grayson
- Community of Hickman
- Community of Empire
- Community of Riverdale
- Turlock Irrigation District (TID)
- Modesto Irrigation District (MID)
- Eastside Water District
- Oakdale Irrigation District (OID)
- Merced Irrigation District
- Ballico-Cortez Water District
- Delhi County Water District
- Hilmar County Water District
- Stanislaus County
- Merced County
- Monterey Park Tract CSD

Figure 2-5 shows the locations of the primary water services areas within the East Stanislaus Region. Water system facilities in the Region are summarized in Table 2-3. Because critical groundwater basins, surface water supplies, habitat features and the agencies managing these resources are all located within the East Stanislaus Region, water supply reliability, water quality, environmental and flood protection can be effectively integrated through the development of the East Stanislaus IRWM Plan.

Figure 2-4: Surface Water and Groundwater Features in and adjacent to the East Stanislaus Region

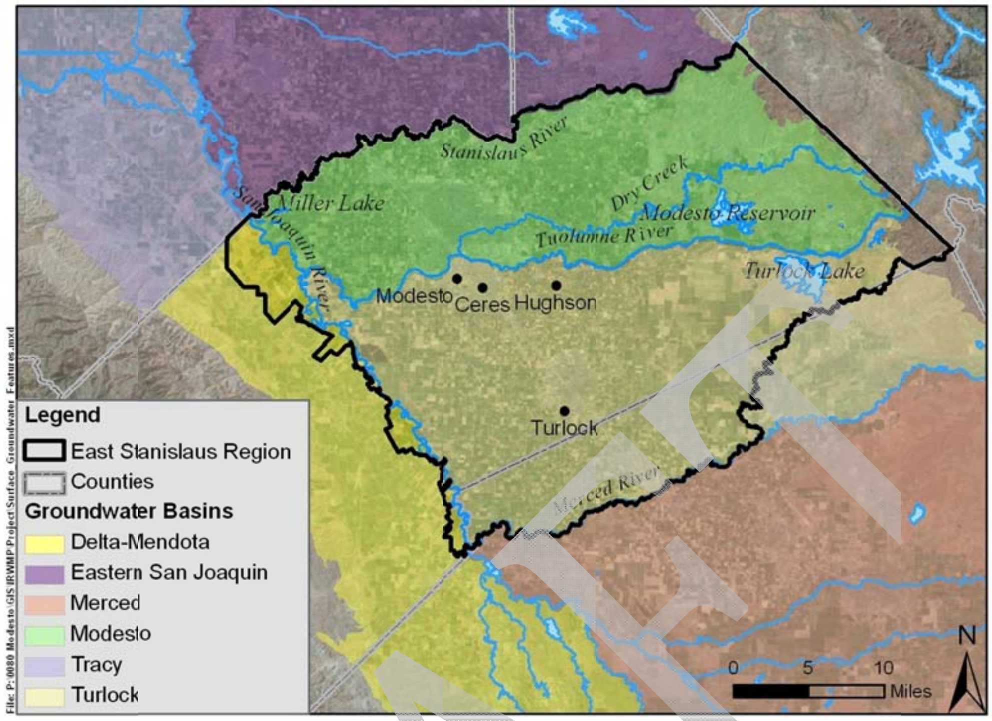
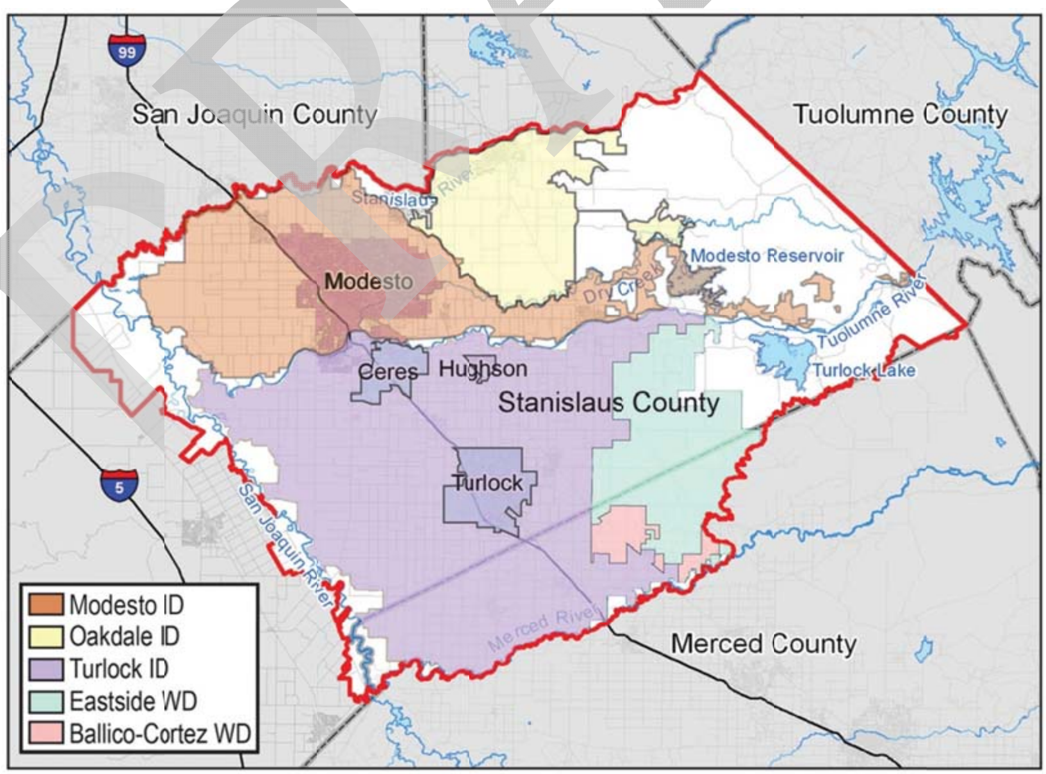


Figure 2-5: Primary Water Services Areas in the East Stanislaus Region



The water system facilities owned and operated by the ESRWMP entities are summarized in the following table. Additional facilities (such as groundwater wells) are owned by other regional stakeholders such as the irrigation districts and community services districts.

Table 2-3: Major Water System Facilities in East Stanislaus Region

Water System Facility	Owner	Description
Modesto Reservoir	MID and Stanislaus County	A raw water reservoir completed in 1911 that is owned and operated by MID. It has a gross capacity of 28,000 acre-feet (AF) and serves as a regulating reservoir for irrigation and domestic water. It is also a recreational area operated by Stanislaus County.
New Don Pedro Reservoir	MID & TID	A raw water reservoir located 4 miles northeast of La Grange in the Sierra Nevada foothills, completed in 1971, and owned and operated by MID and TID. It provides recreation, water storage, power production for MID and TID, and flood control for the Army Corps of Engineers. It has a capacity of 2.03 million AF.
Modesto Regional Water Treatment Plant (MRWTP)	MID	The MRWTP and associated storage/delivery facilities were completed in 1995. It treats Tuolumne River water from MID's Modesto Reservoir, which is then conveyed to the City of Modesto's service area for use. Since 1995, it has provided the City of Modesto 30 million gallons per day (mgd) of treated water. Phase 2, to expand the plant by an additional 30 mgd, is under construction and anticipated to be completed in 2015.
La Grange Dam	MID & TID	The La Grange Dam diverts water for MID and TID. It was completed in 1894.

Water System Facility	Owner	Description
Groundwater wells	Cities of Modesto, Turlock, Ceres, Hughson, Oakdale;	The City of Modesto has 110 groundwater wells located throughout its entire water service area with a total production capacity of 110 mgd. The wells are located in the Modesto, Turlock, and Delta-Mendota subbasins of the San Joaquin Valley Groundwater Basin. The City of Turlock operates 24 active potable groundwater wells and a handful of non-potable wells used for irrigating landscape in City parks. The City of Ceres pumps groundwater from 15 active municipal supply wells which obtain water from the Turlock Subbasin, part of the San Joaquin Valley Groundwater Basin. The wells can produce a total of 14,500 gallons per minute (gpm), but the current firm groundwater pumping capacity is 12,700 gpm. The City of Ceres also has 3 inactive wells that are out of service due to water quality concerns. The City of Hughson's water supply source is derived from five groundwater wells scattered throughout the City. Each well has a capacity ranging from 1,000 to 1,200 gpm. The City of Oakdale operates seven deep groundwater supply wells while the City of Riverbank currently operates 10 municipal supply wells.
Transmission and Distribution Pipelines	Cities of Modesto, Turlock, Ceres and Hughson	The City of Modesto's contiguous water service area has about 940 miles of pipelines. A portion of the transmission pipelines within the City is owned by MID. The City of Turlock maintains over 270 miles of water lines to deliver water to users (17,382 water connections to its potable water system) in a single pressure zone. The City of Ceres' water distribution system consists of a single pressure zone with approximately 140 miles of water pipelines. The City of Hughson conveys water from the wells to consumers via the distribution system that has pipe sizes ranging from 2- to 16-inches in diameter. The City of Riverbank conveys water from the wells to its users via a 44 mile distribution system with pipe sizes ranging from 4 to 12 inches in diameter.

Water System Facility	Owner	Description
Storage Tanks	Cities of Modesto, Turlock, Ceres and Hughson	The City of Modesto has 8 at-grade storage tanks with a combined total storage capacity of 12.1 million gallons (MG). Each storage tank has a booster pump station to pump water from the tank to the distribution system. There are also two 5 MG MRWTP reservoirs that MID owns. The only outlying portion of the City of Modesto's service area that has a storage tank (0.22 MG capacity) is Grayson. The City of Turlock has two at grade reservoirs each with a capacity of one million gallons. East reservoir has a booster pump station to pump water to the water distribution system. A third at grade, one million gallon reservoir will be constructed in 2013. The City of Ceres has two at-grade reservoirs with a combined storage capacity of 3.5 MG. The reservoirs have a booster pump station to pump water to the water distribution system. The City of Hughson has a storage reservoir within the distribution system with a capacity of 750,000 gallons. The City of Riverbank maintains two above-grade reservoirs with a combined storage capacity of 2 MG. The City of Oakdale currently maintains one 0.5 MG reservoir but is planning the addition of a second, 0.6 MG tank.

Notes:
MID – Modesto Irrigation District
TID – Turlock Irrigation District

2.1.4 Wastewater and Recycled Water

Each of the four ESRWMP partner cities (Modesto, Turlock, Ceres, and Hughson) operates a wastewater treatment plant or plants, providing services to their respective service areas. Additionally, the Salida Sanitary District operates a wastewater treatment plant and provides wastewater collection, treatment, and disposal for the unincorporated community of Salida. The influent is currently one half of the plant design capacity (1.2 mgd of 2.4 mgd capacity).

The City of Turlock produces tertiary-treated recycled water, and the City of Modesto recently upgraded its secondary plant to tertiary treatment and is now also producing recycled water. The Cities of Hughson and Ceres treat wastewater to secondary standards and therefore do not produce recycled water meeting Title 22 standards for unrestricted reuse.

Recycled water is recognized as a beneficial water supply due to its many advantages – adding a reliable water source that is consistently available regardless of droughts or climate change, offsetting potable water for other uses, and diversifying agencies' and cities' water supply portfolios. Three of the four members of the ESRWMP have historically worked together to identify regional opportunities for wastewater treatment and recycled water production. An example of a recent cooperative project under consideration is the North Valley Regional Recycled Water

Program (NVRRWP), an effort to regionalize recycled water use in Stanislaus County. As presently envisioned, the NVRRWP could produce and deliver up to 30,600 acre-feet per year (AFY) of disinfected tertiary treated recycled water to western Stanislaus County by 2018. By 2045, NVRRWP could deliver up to 59,900 AFY of recycled water. The source of recycled water includes treated wastewater from the Cities of Turlock, Ceres, and Modesto. As part of the project, the City of Turlock would install an additional 5.7 miles of conveyance pipeline to convey water directly from its Regional Water Quality Control Facility's tertiary treatment plant to the Delta-Mendota Canal (DMC). The Canal would be used to convey the blended canal-recycled water to users in the west side of the County (City of Turlock, 2011). Funding from the USBR has been pursued for completion of feasibility studies related to the NVRRWP; however, no funding has been secured to date. Information regarding the NVRRWP can be found on the project website at http://www.nvr-recycledwater.org/.

City of Modesto

Treatment of the City of Modesto's raw wastewater occurs at the Sutter Avenue Primary Treatment Plant and Jennings Road Treatment Plant, located on two sites with the City of Modesto. The Sutter Avenue Primary Treatment Plant provides pumping, screening, grit removal, flow measurement, primary clarification and sludge digestion. The primary effluent is then conveyed to the secondary treatment plant, the Jennings Road Treatment Plant, where it is treated further and either discharged or stored until it can be discharged. The City currently disposes of the secondary treated effluent in two ways: through irrigation to land that it owns (namely, a 2,526 acre ranch), and through seasonal discharge to the San Joaquin River, both of which are pursuant to National Pollutant Discharge Elimination System (NPDES) Permit No. CA0079103. The Jennings Road Treatment Plant has recently been upgraded to a tertiary treatment system with the implementation of Phase 1A of its Tertiary Treatment Project, providing up to 2.3 mgd of tertiary-treated water. Phase 2 of the project is currently under construction and will add 12.6 mgd of tertiary treatment, allowing for compliance with the City's NPDES Permit and permitting year-round discharge to the San Joaquin River.

Solids handling at the Jennings Road Treatment Plant was analyzed in the *2008 Wastewater Treatment Master Plan Update* (Carollo, 2007e). The biological nutrient removal (BNR)/tertiary facilities constructed during Phase 1A produce waste activated sludge (WAS) that needs to be properly disposed of. The alternative to process the WAS in the recirculation channel and ponds was determined to be the most economical approach in the *Wastewater Treatment Master Plan Update*. It also has low energy requirements and does not require WAS thickening. The dried solids are then beneficially applied to the City's ranch lands (Carollo, 2008).

Historically, about 20 mgd of cannery wastewater with high concentrations of organic vegetable solids were sent to the primary treatment plant, causing the treatment plant to operate inefficiently. To address this problem, in the late 1990's, the Cannery Segregation Project was implemented such that now, up to 40 mgd of wastewater from seasonal canneries is segregated and bypasses treatment. These cannery discharges are applied directly to city-owned ranchlands as a soil supplement.

Current and projected wastewater flows for the City of Modesto are presented in Table 2-4. The wastewater treatment plants serve the City's sanitary service area and a small portion of Ceres, as described later in this section.

Table 2-4: City of Modesto Wastewater and Treatment, AFY

	2005	2010	2015	2020	2025	2030	2035
Wastewater Collected and Treated [a]	29,100	27,100	28,900	32,500	36,400	40,300	44,400

Source: West Yost, 2011b.

a. Wastewater collected and treated is equivalent to recycled water produced and available for beneficial reuse.

The City analyzed opportunities to reuse the tertiary recycled water with the completion of a feasibility study in 2005. The feasibility study assessed recycled water markets, reviewed regulatory requirements, and developed and evaluated alternatives for regional water recycling and wastewater treatment. As part of the study, stakeholder workshops were conducted to discuss and gain input on the recycled water opportunities. Seventeen local communities and agencies were invited to participate in the workshops and nine cities and agencies participated. This work has been refined, and the City is currently considering supplying tertiary treated recycled water to Del Puerto Water District (DPWD), as well as other potential users in western Stanislaus County, with the implementation of the NVRRWP. Although the NVRRWP would not provide a potable water offset directly to the City of Modesto service area, the treated wastewater would be used beneficially and would provide water supply reliability, public safety, enhanced property values and increased educational opportunities (West Yost Associates, 2011b).

City of Turlock

In 2006, the City of Turlock's Regional Water Quality Control Facility (WQCF) was upgraded to tertiary treatment, producing recycled water compliant with Title 22 requirements for unrestricted reuse. All existing and future treated wastewater flows will be treated to recycled water standards, potentially available for beneficial reuse. Table 2-5 presents the wastewater collected and treated in the City's service area. The City is currently permitted to use the recycled water for industrial cooling (2 mgd) and landscape irrigation at Pedretti Baseball Park (up to 20 MG/year) as part of the City's Recycled Water Program, which was approved by the California Department of Public Health (CDPH) in 2006. The recycled water for industrial cooling is delivered to Turlock Irrigation District for use at the Walnut Energy Center, a 250 megawatt (MW) natural gas power plant located in Turlock.

Table 2-5: City of Turlock Wastewater Collection and Treatment, AFY

	2005	2010	2015	2020	2025	2030	2035
Wastewater Collected and Treated[a]	14,482	12,935	14,636	16,557	18,733	21,194	23,980

Source: City of Turlock, 2011.

a. Wastewater collected and treated is equivalent to recycled water produced and available for beneficial reuse.

The City of Turlock currently discharges recycled water that is not used to the San Joaquin River via the Harding Drain, a man-made agricultural drain. The City plans to build a pipeline as part of the NVRRWP that will bypass Harding Drain to allow for recycled water delivery to DPWD, who provides irrigation water to about 11,000 acres of farmland in western Stanislaus County. The City's 2010 Urban Water Management Plan (UWMP) Update assumes the City would begin selling 4,000 MG/year of recycled water to DPWD in 2020. The City will continue to use 400 MG/year of recycled in its service area.

In the City's 2005 UWMP, the City predicted using a larger volume of recycled water in its service area than amounts actually delivered. Multiple factors explain why the use of recycled water has not met the previous projections:

- Regulatory Approval - the approval process required approval from three separate State agencies (State Water Resources Control Board (SWRCB), Regional Water Quality Control Board (RWQCB), and CDPH).
- Water Quality Requirements - at first, the newly constructed tertiary treatment processes at the City's WQCF did not meet all water quality standards required for recycled water use. The City has since modified the treatment processes to gain compliance.
- Infrastructure Construction - implementation and construction of a recycled water distribution system has taken longer than anticipated.
- Economic Downturn - the overall economic decline limited customer growth and dampened demand for recycled water.

In 2010, the City worked with ECO:LOGIC to complete a recycled water pricing analysis and develop a price for recycled water that would provide significant incentive to industrial customers to switch to recycled water. The cost of recycled water is cheaper than potable water, but the City lacks the necessary recycled water distribution facilities, and customers that are further from the one existing recycled water distribution line are faced with significant construction costs to extend recycled water distribution lines. The expansion of a recycled water distribution system within the City would allow for more recycled water use and potable water offsets (City of Turlock, 2011).

City of Ceres

The City of Ceres does not currently produce or deliver recycled water, but in recent years, it has evaluated the potential to develop recycled water to offset potable water use and assist with wastewater disposal. Presently, the City collects and treats wastewater for customers within city boundaries, except the northwest portion of the city. The City manages collection in the northwest portion of the city, but currently exports about 1.3 mgd of wastewater to the City of Modesto's trunk sewer system. The City also exports a significant portion of its treated wastewater from its wastewater treatment plant (WWTP) to the City of Turlock's WQCF.

The City of Ceres Wastewater Treatment Plant has been at its existing location since before 1970, and treats 3.1 mgd of wastewater on average. No treated wastewater is discharged to a surface water body; instead, treated effluent is either discharged into on-site ponds for evaporation and incidental groundwater recharge (up to 2.5 mgd) or exported to the Cities of Turlock or Modesto (up to 1 mgd to each location). Wastewater treatment and disposal at the City's WWTP is regulated by Waste Discharge Requirements (WDRs) Order no. 93-237. Current and projected wastewater flows are presented in Table 2-6 (West Yost Associates, 2011a).

Table 2-6: City of Ceres Wastewater Collection and Treatment, AFY

	2010	2015	2020	2025	2030	2035
Wastewater Collected and Treated	4,800	5,800	6,700	7,700	8,600	9,600

Source: West Yost, 2011a.

The City's wastewater flow projections, as shown in Table 2-6, exceed currently available disposal capacity, so the City has explored disposal options. Tertiary treatment and water recycling is currently not being considered due to significantly higher costs than other disposal options resulting from required upgrades. (Areas that could potentially use recycled water in the City's service area have been identified, but it was determined not to be cost effective to add tertiary treatment and install dual piping.) Other disposal options include increased exports to the City of Turlock and increased exports to the City of Modesto, both of which will be explored further. The City of Ceres is in the process of buying another 1 mgd of capacity of Turlock's WQCF in order to export up to 2 mgd of its wastewater flows. The Central Valley Regional Water Quality Control

Board (RWQCB) is reluctant to add another discharger to the San Joaquin River. Under current RWQCB policy, regionalization is preferred whenever feasible. Regionalizing the Cities of Modesto and Turlock wastewater treatment facilities would provide greater economies of scale than the City of Ceres constructing its own treatment and/or disposal facilities (West Yost, 2011a).

City of Hughson

The City of Hughson operates the Hughson Wastewater Treatment Plant (WWTP), located adjacent to the Tuolumne River, north of the city. Most of the flows to the WWTP come from residential users except for a creamery owned by the Dairy Farmers of America (DFA) which is permitted specific flows and wastewater characteristics. The City is approximately 70% built out within the City limits, with agricultural land use dominating the areas surrounding the City boundary. The City's original WWTP was constructed in 1947 by the Hughson Sanitary District. The City took over the function of the Sanitary District in 1972, and in 1983, constructed the existing WWTP which began operation in 1986. Over the years, the WWTP has had a number of improvements, at times necessitated by violations issued by the RWQCB and operational issues. In 2003, the City's Hatch Road Pump Station broke down, and the RWQCB issued a Notice of Violation calling for improvements. Although repairs were made, this critical lift station continues to experience more problems. The existing treatment processes at the WWTP include screening, grit removal, denitrification, extended aeration, secondary clarification, and chlorine disinfection, and the effluent is discharged to 10 evaporation and percolation ponds.

In 2004, a *Peer Review and Preliminary Design Report Technical Memorandum* was prepared which noted that the WWTP, as originally designed, was having difficulty meeting plant effluent and groundwater limits as stated in the City's WDR Order No. 5-00-024 and a Notice of Violation was issued in July 2003. More capacity at the plant was also required, so an interim upgrade project was designed and constructed in 2005 and 2006. The WWTP Interim Upgrades Project added two treatment ponds, a pump station and other peripherals. In December 2005, the RWQCB renewed its Notice of Violation for issues that were not addressed by the interim updates to the WWTP. In response to the Notice of Violation, the City prepared its 2007 *Wastewater Treatment Plant Master Plan* to develop an approach to upgrade the WWTP based on projected flows and loadings through the year 2025 while also meeting current and anticipated discharge requirements from the Central Valley RWCQB. The improvements identified in the Master Plan were analyzed in an Environmental Impact Report (EIR), prepared in 2007. The EIR included environmental review of new headworks at the existing WWTP, including course and fine screens, a Parshall flume, and biofilters for odor control, as well as two new trapezoidal oxidation ditches to the west of the plant, two 70-foot diameter secondary clarifiers and three percolation ponds. Other improvements analyzed were a RAS/WAS pump station, two new gravity belt filter presses for dewatering, upgrades to the operations center, and a supervisory control and data acquisition system. Additionally, the Hatch Road influent pump station and associated force main were to be removed and a new 36-inch gravity sewer and influent pump station added. Upon completion of the EIR, the improvements and upgrades were constructed at the City's WWTP. Overall plant capacity was increased from 1 mgd to 1.9 mgd (Quad Knopf, 2007).

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

City of Riverbank

The City of Riverbank owns and operates its own wastewater collection and treatment system. The City's Wastewater Treatment Plant (WWTP) is located north of Riverbank across the Stanislaus River and borders the north side of Jacob Myers Park.

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

City of Oakdale

The City of Oakdale owns and operates its own sewage collection system and Wastewater Treatment Plant (WWTP). The City's WWTP is designed to treat up to 2.4 mgd of domestic and industrial wastewater. The facility uses two aerated lagoons for primary treatment. Effluent from the lagoons flow by gravity to a single secondary clarifier, and treated effluent is discharged to one of 11 evaporation/percolation ponds. At present, the City is looking to upgrade its WWTP to add a second secondary clarifier, a new disinfection facility, and a new or expanded biosolids treatment facility

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

2.1.5 Stormwater and Flooding

Stormwater Management

Flood management consists of flood prevention, response, and recovery, generally provided by flood control infrastructure, operation and maintenance (O&M) of that infrastructure, non-structural flood control such as land use decisions that do not place assets in areas with a high probability of flooding, and providing financial assistance, counseling, and assistance after flood events (ESA, 2013). Storm drainage systems are used to reduce the chance of flooding and to meet regulatory requirements regarding stormwater runoff. A Stormwater Management Plan (SWMP) was prepared for Stanislaus County in 2004. As an operator of a Small Municipal Storm Sewer Systems (MS4) that serves urbanized areas, the County filed a Notice of Intent to participate in the SWRCB General Permit. To comply with State and Federal requirements, also referred to as Phase II Stormwater Requirements, designated MS4s must develop a plan to implement measures to control stormwater quality, develop a 5-year plan for implementation and an associated budget. The SWMP for the County covers the County's unincorporated communities, including Empire, Keyes, Salida, Crow's Landing, Denair, Diablo Grande, Del Rio, Grayson, Hickman, Knight's Ferry, La Grange, Sunset Oaks Estates, Valley Home and Westley, as well as the industrial area known as Beard Tract between Modesto and Empire. The Cities of Modesto, Turlock, Ceres, Hughson, Oakdale, Patterson, and Riverbank are also subject to Phase II Stormwater Requirements. Ceres, Oakdale, Patterson, and Riverbank prepared a joint-Stormwater Management Program in 2003. The Cities of Modesto, Turlock, and Hughson have each prepared individual SWMPs.

In most rural parts of Stanislaus County, stormwater runoff is handled by field percolation or through roadside ditches which then drain to Dry Creek, Tuolumne River, Stanislaus River, or San Joaquin River. While the majority of agricultural lands on the valley floor do not require drainage, there are some lands in the rolling hills to the east which generate runoff. For example, runoff from Mustang Creek and Sand Creek drain to the TID canal system, and runoff from McDonald Creek eventually drains to Turlock Lake where flows are routed through the TID canal system to the river.

There are few storm drain facilities constructed in rural areas. The Beard Tract covers about 5,000 acres and the streets have curb/gutter storm drains that discharge to Tuolumne River. Unincorporated communities in the County typically have constructed storm drain facilities that are owned, operated, and maintained by the County (Stanislaus County, 2004). Some rural systems pump stormwater to the TID canal system which is used to convey runoff to the river system.

In 2008, the City of Modesto prepared Storm Drainage Master Plan (SDMP) to identify major storm drainage infrastructure improvements that are needed or would be needed in the future. The City also prepared a Stormwater Management Plan in August 2009 to comply with Phase II requirements. Historically, the City has used a rockwell system, a positive storm drainage system, or no system. The City's Public Works Department operates and maintains 77 miles of storm drain lines, 21 pump stations, 24 drainage basins, and about 10,500 rockwells. The rockwells are used to percolate stormwater runoff into the ground, but these can lead to groundwater quality concerns. In addition to potentially impacting water quality, the rockwells are expensive to maintain and overall, the City's system is deficient in its ability to drain stormwater runoff and minimize localized flooding in many areas. In some areas of the City, it uses a positive storm drainage conveyance system that discharges to the Tuolumne River, Dry Creek, detention basins, and irrigation facilities owned and operated by MID and TID. Some of these systems are in need of retrofit and repair to properly serve the areas (Stantec, 2008). In the areas of the City of Modesto where there are no permanent storm drain systems, the City uses the sanitary sewer to drain stormwater runoff and reduce flooding. There are a total of 52 storm drain cross-connections, most of which are located in the downtown area. These can cause a dramatic increase in Peak Wet Weather Flow at the City's wastewater treatment plant, so the City is interested in removing the cross-connections from the wastewater collection system (Carollo, 2007f).

In order for the City of Turlock to comply with the Waste Discharge Requirements for Stormwater Discharges from MS4s, in 2003, it prepared a Stormwater Management Plan (SWMP). The City of Turlock owns and operates its own stormwater system that includes 28 active storm lift stations, 66 storm ponds totaling 140 acres, 1,300 stormwater catch basins and 102 miles of storm drain pipe. Stormwater runoff is transferred through storm pipes to a storm basin where it either percolates to the groundwater basin or is pumped to a larger storm basin or canal. Stormwater runoff that reaches the larger storm basin percolates to and recharges the groundwater basin, If excess stormwater is pumped to a canal, it is discharged to the San Joaquin River. To protect water quality, the City of Turlock implements Best Management Practices (BMPs) as required by its MS4 permit (Turlock, 2003). Additionally, the City of Turlock implemented an environmental stewardship program called "Go Green" that has a stormwater pollution prevention component in it, and is also heavily related to water conservation (City of Turlock, 2011).

The City of Hughson provides positive storm drainage for its service area; the system includes pipelines, four stormwater pump stations, rockwells, and detention and retention basins. Stormwater is discharged to TID via three discharge points to its irrigation canal, and the Ceres Main Canal. Currently, stormwater is discharged from the detention basins to the TID canal once a significant portion is in the basin. Most of the stormwater runoff in the City goes through storm basins, while some is discharged directly to the canal. In 2007, the City of Hughson also completed a Storm Drainage Master Plan to help plan, develop, and finance the storm drainage system facilities. The report recommended a number of improvements to the existing system including upsizing many of the pipelines, constructing new pipelines, and constructing a new basin. Overall, the City's storm drainage system is in good condition. The City maintains, cleans and repairs lift stations and pipelines as needed. Some areas within the City have localized flooding problems due to the lack of positive drainage facilities; City crews typically eliminate any storm inlet plugging and street flooding/ponding within a half-day. During a major storm in 1997 (a 170-year storm event) the most significant issue was the high inflow of stormwater runoff into the sanitary sewer system which then caused problems at the wastewater treatment plant (Carollo, 2007b).

In 2003, the Cities of Ceres, Oakdale, Patterson, and Riverbank adopted a Memorandum of Understanding (MOU) to jointly apply for permit compliance. They prepared a Stormwater Management Program that described their positive storm drainage services they provide to their communities. The City of Ceres stormwater system includes 33 detention/retention basins, about 100 rockwells, 33 stormwater pump stations, pipelines, and 27 discharge points to receiving streams and canals. Stormwater is discharged to detention basins for percolation, to TID canals, or the Tuolumne River. Oakdale has 22 detention / retention basins, 8 stormwater pump stations, about 200 rockwells, pipelines, and 9 discharge points to streams and canals. Stormwater is disposed of by percolation, and/or discharged to the Stanislaus River and OID canal. Some of the stormwater is discharged directly to the river, while some enters a stormwater basin prior to discharge. Patterson has 14 detention/retention basins, 5 stormwater pump stations, pipelines, and multiple discharge points to Salado Creek, Patterson Irrigation District canals, and San Joaquin River. There is a portion of Stanislaus County development that discharges to Black Gulch, a tributary to Salado Creek above Patterson's service area. Runoff from the developed County area impacts stream hydrology in Salado Creek through Patterson. Storm drainage master plans were prepared in 1992 and 2001 to address the flooding along Salado Creek and Black Gulch. The study recommended $20 million of improvements to the storm drainage system be constructed. Some of the improvements have been constructed while other improvements have not as they require cooperation from other agencies such as the U.S. Army Corps of Engineers. In the past, Patterson's wastewater treatment plant received infiltration from stormwater runoff during storms, but the City has been eliminating infiltration through infrastructure improvements. Riverbank's storm drainage system consists of pipelines, 6 detention/retention basins, about 100 rockwells, 7 pump stations, and 8 discharge points to Stanislaus River and the MID Main Canal. The Cities of Ceres, Oakdale, Patterson, and Riverbank have a few stormwater quality incidents each year. Dumping of chemicals into storm drains may occur and a few illegal connections of house sewers to storm drains were found, but eliminated. The cities do not conduct routine stormwater quality monitoring and new storm drainage infrastructure will be constructed by developers as the City grows (Tulloch, 2003).

Flooding

During storms, there is occasional flooding in Stanislaus County because of a combination of factors: high groundwater, low percolation soils, and topography (Stanislaus County, 2004). The flood management system in the San Joaquin Valley includes reservoirs to regulate snowmelt from elevations greater than 5,000 feet, bypasses at lower elevations, and levees that line major rivers. Typically, snowmelt floods are more frequent in the San Joaquin Valley than rain floods, but rain floods do occur and generally have higher peak flows than snowmelt floods. The following table shows the discharge-frequency relationships for some of the rivers and creeks in the East Stanislaus Region as described by FEMA (ESA, 2013).

Table 2-7: Discharge Frequency Relationships for Rivers

		Peak Discharges (cubic feet per second)			
Location	Drainage Area (square miles)	10-year	50-year	100-year	500-year
Tuolumne River at Modesto	1,884	10,500	32,000	70,000	154,000
Tuolumne River at Waterford	1,640	9,000	10,000	42,000	225,000
Stanislaus River at Oakdale	1,020	7,600	8,000	8,000	41,300
Dry Creek at Modesto	192.3	4,730	9,300	11,800	18,100

Source: ESA, 2013

The San Joaquin River, upstream of the Tuolumne River and down to the Merced River confluence, has a design capacity of 45,000 cfs, but a current capacity estimated to be 22,000 cfs to 35,000 cfs. Downstream of Tuolumne River to Stanislaus River, the design capacity of the river is 46,000 cfs, while the current capacity is only 25,000 cfs. The lowest reaches of Stanislaus River have a design capacity of 12,000 cfs, but its current capacity is 23,000 cfs. The lowest 0.6 miles of the Tuolumne River have a design capacity of 15,000 cfs; the current capacity is not estimated, but landowners along the river report flood damages when flows exceed 8,200 cfs.

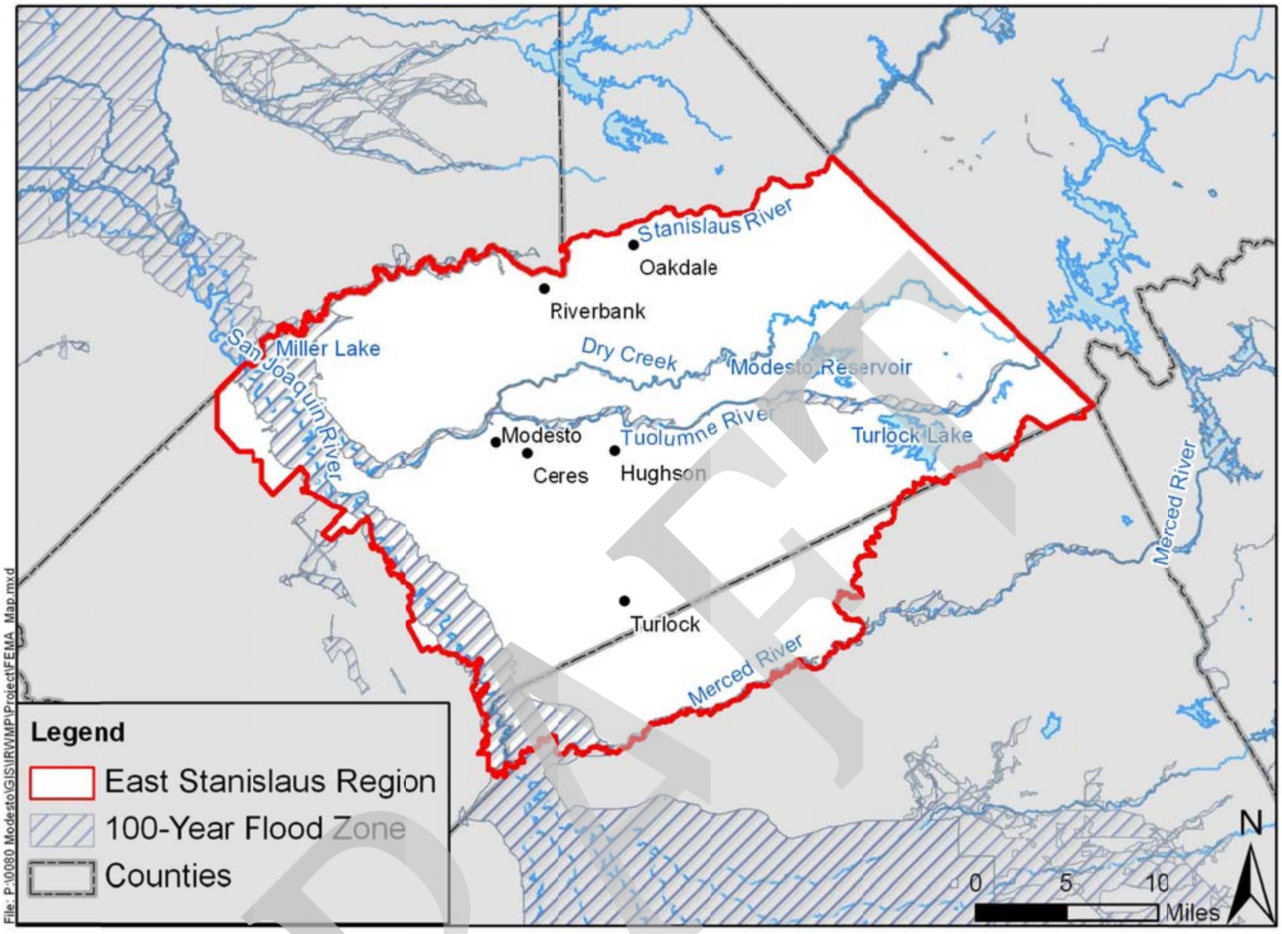
In 1983, four levees broke in the San Joaquin River Basin. One of the levees that broke was within the Mid-San Joaquin River Region, an area generally described as the floodplain corridor extending along the mainstem San Joaquin River, from its confluence with the Merced River to its confluence with the Stanislaus River, and the lower reaches of the Merced, Tuolumne and Stanislaus Rivers that are within the State Plan of Flood Control. This levee break occurred on March 5th of 1983 along the left bank of the San Joaquin River, just downstream of its confluence with the Tuolumne River and along the San Joaquin River National Wildlife Refuge. The break resulted in the inundation of 500 acres, causing $12 million of losses in agricultural damages in Stanislaus County. In 1986, there were a series of storms from February 11th to the 19th in which several precipitation records were set. Precipitation in a 300 mile wide band from San Francisco to Sacramento to Lake Tahoe ranged from 100 to 200% of normal. While this caused flooding and damage, there were no damages sustained in Stanislaus County. (ESA, 2013). Some older areas of Stanislaus County have problems with flooding during storms that exceed ½-inch per hour due to inadequate drainage.

During the 170-year storm of 1997, the County experienced flooding in some areas surrounding Tuolumne River due to the release of excess water from Don Pedro Dam and Reservoir into the Tuolumne River channel. The second wettest December on record in the Sierra Nevada occurred in 1997 which contributed to the flooding. Additionally, there were three tropical storms that hit Northern California on December 29, 30, and 31, 1996. Within three days, more than 30 inches of rain fell in the upper watersheds of the Sierra Nevada. Record flows were a result in the Sacramento and San Joaquin River Basins. In mid-December, a cold storm brought snow to the Sierra Nevada foothills which melted during the three warm storms at the end of December. Approximately 15% of the total runoff volume was from the snowmelt. Millerton Lake and Don Pedro Reservoir both exceed their design capacity. Flooding occurred along the Merced River

Tuolumne River, and San Joaquin River. Areas within Modesto, Ripon, Waterford, and La Grange were inundated. Multiple levees failed on the San Joaquin River, or were breached, leading to further flooding in nearby areas. Flooding did not occur in the Cities of Patterson, Newman or Turlock. Then in 1998, during 35 days of above average rainfall, upland areas of Stanislaus County experience sheet flooding in a number of new subdivisions near saturated rural areas (Stanislaus County, 2004). Some low-lying areas of the lower reaches of the Tuolumne River, some near the confluence with Dry Creek are subject to occasional flooding.

The Federal Emergency Management Agency (FEMA) delineates 100-year floodplains for FEMA Flood Insurance Rate Maps (FIRMs). A majority of the San Joaquin River's 100-year flood plain (in this stretch of the San Joaquin River) is within the Region, but overall, not much of the East Stanislaus Region is described as being within a 100-year floodplain (Figure 2-6). FEMA prepared the approximate floodplain mapping, but did not conduct detailed floodplain analysis. The City of Modesto performed detailed floodplain analyses to map the 100-year floodplain. According to the Stanislaus County Multi-Hazard Mitigation Plan prepared in 2010, an estimated 2,400 people live within the 100-year floodplain of the San Joaquin River within Stanislaus County. The estimated total property value, including private property, in that same area is approximately $150 million. Flood hazards in the region are areas that are naturally flood-prone, along major rivers, and potentially near levees that are in poor condition. The cities of Modesto, Newman, Patterson and the communities of Westley and Grayson are exposed to flood risk during large runoff events. Flooding occurs in Modesto at the confluence of the Tuolumne River and Dry Creek during intense storms and especially when releases from Don Pedro reservoir are high. Agricultural areas along the San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are also exposed to flood risk, as well as lands managed to preserve habitat along the San Joaquin, Tuolumne, and Stanislaus Rivers (ESA, 2013). Some development in the region is planned within the 100-year floodplain, but development will be restricted by the City's floodplain zoning ordinance. If areas within the 100-year floodplain are to be developed, properties are usually constructed on fill (Stantec, 2008).

Figure 2-6: 100-Year Flood Plain Maps for Water Bodies within the East Stanislaus Region



The East Stanislaus Region, as part of its IRWM planning process, is currently participating in the development of a Regional Flood Management Plan for the Mid-San Joaquin Region to identify potential projects that may improve flood management. As part of FloodSAFE California, DWR initiated a comprehensive Statewide Flood Management Planning Program to assess flood risks statewide and inform development of the State's flood management policies and investment decisions over the next 10 to 15 years. DWR prepared the Central Valley Flood Protection Plan (CVFPP) in June 2012, which calls for DWR to work with local flood management agencies to prepare detailed Regional Flood Management Plans that, at a minimum, identify and articulate the following:

- Describe flood management challenges and deficiencies at the regional level including operations and maintenance practices, levee and channel inspection, and emergency response plans.
- Propose potential solutions/projects identified by local public agencies and interest groups for the region, projects' costs, and prioritization of the solutions/projects enhanced operations and maintenance, emergency response, and floodplain management.
- Propose financial strategies that identify benefits of the projects and sources of the funding for implementation of the projects.

The Mid-San Joaquin River Region planning area lies within the East Stanislaus IRWM Region, along its western boundary. Also, because flood concerns related to the San Joaquin River and its tributaries extend beyond the specific area, the geographic extent of the Mid-San Joaquin Region (the area covered in the Mid-San Joaquin River Regional Flood Management Plan) is the Reclamation Districts identified in the Draft Regional Atlas, as well as the Cities of Modesto, Ceres, Turlock, Patterson, and Newman; the communities of Grayson, West Stanislaus, and El Solyo; Del Puerto Water District; Modesto and Oakdale Irrigation Districts; Newman Drainage District; and all the areas between the Merced/San Joaquin River confluence and the Stanislaus/San Joaquin River confluence with a nexus to flood management. Preparation of the Mid-San Joaquin River Regional Flood Management Plan (RFMP) began in March 2013 and is expected to be complete in December 2014. It is one of six regional Central Valley RFMPs to be developed (ESA, 2013).

2.1.6 Natural Resources

The East Stanislaus Region, as with most of California, is rich with natural resources. Most land in Stanislaus County has been cultivated, and very limited mineral was found within its boundary. In the early 1900's, some quicksilver, manganese, and magnesite were found, as well as silica, sand and clays. Gravel from the Stanislaus River near Oakdale was used for roads. In La Grange, mining for gold was successful (Perazzo, 2011).

Stanislaus County is primarily agricultural, except for the urban areas. Up until about 1960, most of the County's population lived on farms. In the early 1990's, when Stanislaus County prepared its General Plan, the population of the nine incorporated cities was nearly three times that of the unincorporated area of the County. In its General Plan, the County applies agriculture land use to areas suitable for open space and recreational use.

Regional parks are valuable in preserving natural resources, such as river and riparian areas. River corridors and floodplains are some of the most ecologically valuable areas in the landscape, especially in an area like the Central Valley of California that has an arid climate. The rivers and floodplains are important for fish species, including anadromous species such as salmon and steelhead, and also provide wintering areas for migratory birds on the Pacific Flyway. The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are characterized as Critical Habitat for steelhead trout, as designated by the U.S. Fish and Wildlife Service. Other Critical Habitats in the Region include those for the vernal pool tadpole shrimp and vernal pool fairy shrimp. Riparian and wetland sensitive species within the San Joaquin River and the lower reaches of the Merced, Tuolumne, and Stanislaus Rivers include Delta button-celery, valley elderberry longhorn beetle, riparian woodrat, riparian brush rabbit, wading bird rookeries, least Bell's vireo, tricolored blackbirds, Swainson's hawk, pallid bat, and western red bat.

The Stanislaus River National Wildlife Refuge covers nearly 8,000 acres; approximately three-quarters of this area was specifically acquired to allow floodwater to temporarily move out onto the floodplain, now in flood-compatible land use. Extensive riparian vegetation is present within the Wildlife Area and there are small swaths of riparian vegetation along the San Joaquin River from the confluence with the Merced River to the confluence with the Stanislaus River. Similarly, the Dos Rios Ranch is a 1,600 acre area managed by the Tuolumne River Trust and River Partners located at the confluence of the Tuolumne and the San Joaquin Rivers provides six miles of river frontage and is managed for habitat and attenuation of flood flows (ESA, 2013).

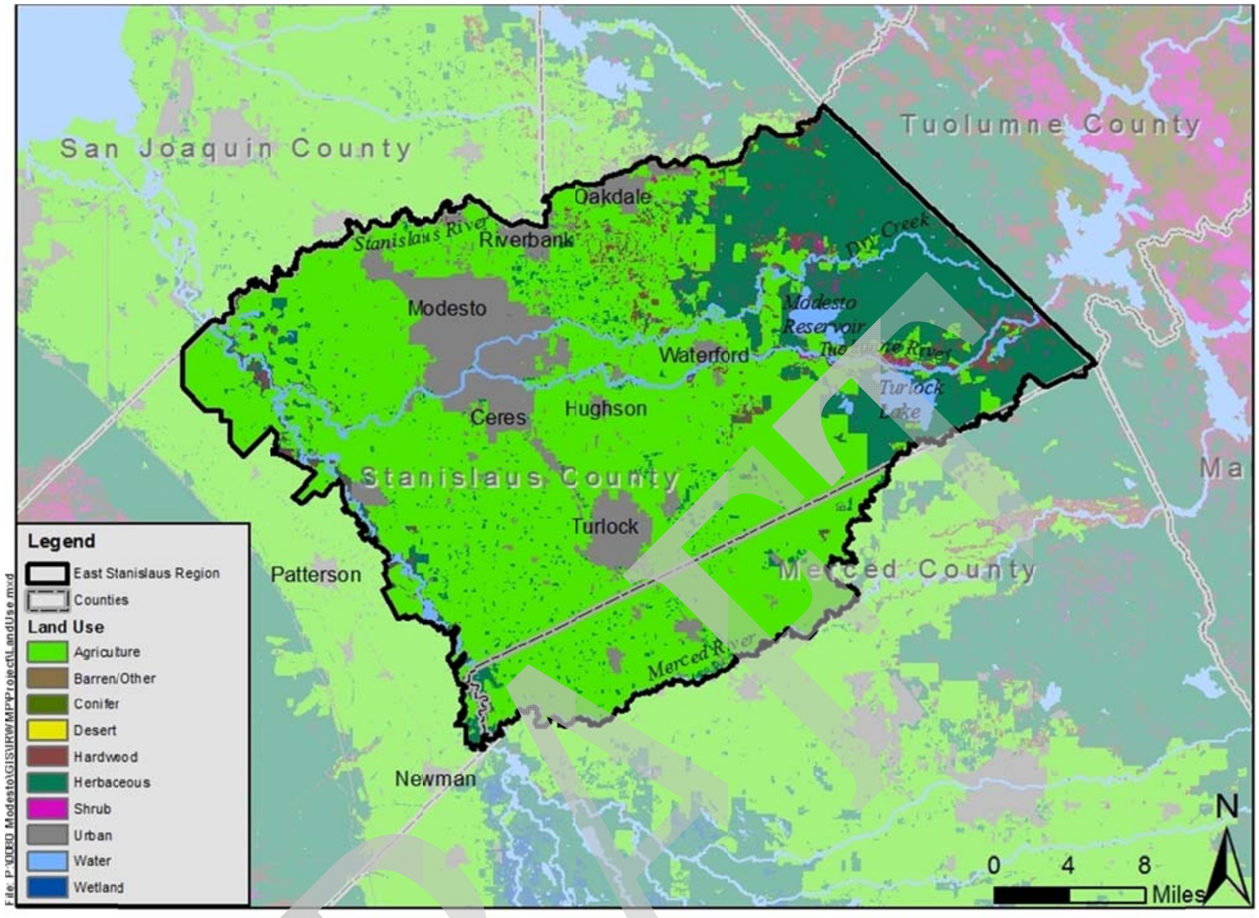
2.1.7 Social and Cultural Composition

The East Stanislaus County IRWM Region encompasses most of Stanislaus County and a portion of Merced County. Based on the 2010 Census data, Stanislaus County had a 2010 population of 514,453, an increase of 15.1% from 2000. The County's population is approximately 65% white, approximately 42% of which are of Hispanic or Latino origin. Asians provide the next largest demographic population, composing approximately 5% of the county's population. Native Americans compose approximately 1% of the county's population. Merced County is smaller than Stanislaus County (with a total population of 255,793 in 2010, a 21.5% increase from 2000); however, its population demographics are similar. Approximately 58% of Merced County's population is white, though unlike Stanislaus County, approximately 55% of this population is of Hispanic or Latino origin. Approximately 7.5% of the county's population is Asian, while Native Americans compose approximately 1.4% of the county's population.

The cities within the East Stanislaus Region had all been experiencing extremely rapid growth within the last decade, up until the most recent economic downturn. As previously noted, Stanislaus County's population increased by 15% between 2000 and 2010 while Merced County's population increased by 21.5% in that same period, as compared to a 10% growth rate for the State as a whole. This trend is also seen locally. For example, according to the 2000 U.S. Census, there were 3,980 people living in the City of Hughson in the year 2000, resulting in a 22% increase since 1990, equivalent to an average annual growth rate of 2.2%. In 2005, Hughson's population was estimated at 5,942, resulting in an annual growth of 10%. According to the 2010 U.S. Census, population in the City of Hughson in 2010 was 6,640 (a 67% increase in population between 2000 and 2010). Although the City continued to grow, growth slowed down as demonstrated by the 12% increase from 2005 to 2010, which equates to annual average growth rate of 2.4%, much lower than the previous 10% annual growth rate.

Agriculture is the primary industry in the East Stanislaus Region, except in urban centers (city limits). The region includes all or portions of five irrigation districts, providing water to over 300,000 acres. Figure 2-7 shows land uses in the East Stanislaus Region.

Figure 2-7: Land Use in the East Stanislaus Region



The East Stanislaus Region is also home to many disadvantaged communities, whose involvement in the IRWM process will be essential. A Disadvantaged Community (DAC), according to the State of California (California Water Code (CWC), Section 79505.5(a)), is a community with a Median Household Income (MHI) less than 80 percent of the California statewide MHI. DWR compiled the U.S. Census Bureau's American Community Survey (ACS) data for the period of 2006 to 2010. Based on this data, a community with an MHI of $48,706 or less is considered a DAC. Within the East Stanislaus Region, the communities of Keyes, Bret Harte, Bystrom, Empire, Grayson, Shackelford, West Modesto, Riverdale Park, Cowan, Parklawn, Rouse, and portions of Modesto, Turlock, Denair, Hughson, Oakdale, Waterford, and Ceres are DACs. Involvement and participation by representatives of these communities during the East Stanislaus IRWM planning process was solicited and encouraged to help understand the issues confronted by DACs and to better address the needs of minority and/or low-income communities. Figure 2-8 identifies the DACs based on the data defined at the census block group level. A census block group is a cluster of census blocks, generally containing between 600 and 3,000 people. Table 2-7 lists the DACs in the East Stanislaus Region and their associated MHIs.

Figure 2-8: Disadvantaged Communities Located in the East Stanislaus Region

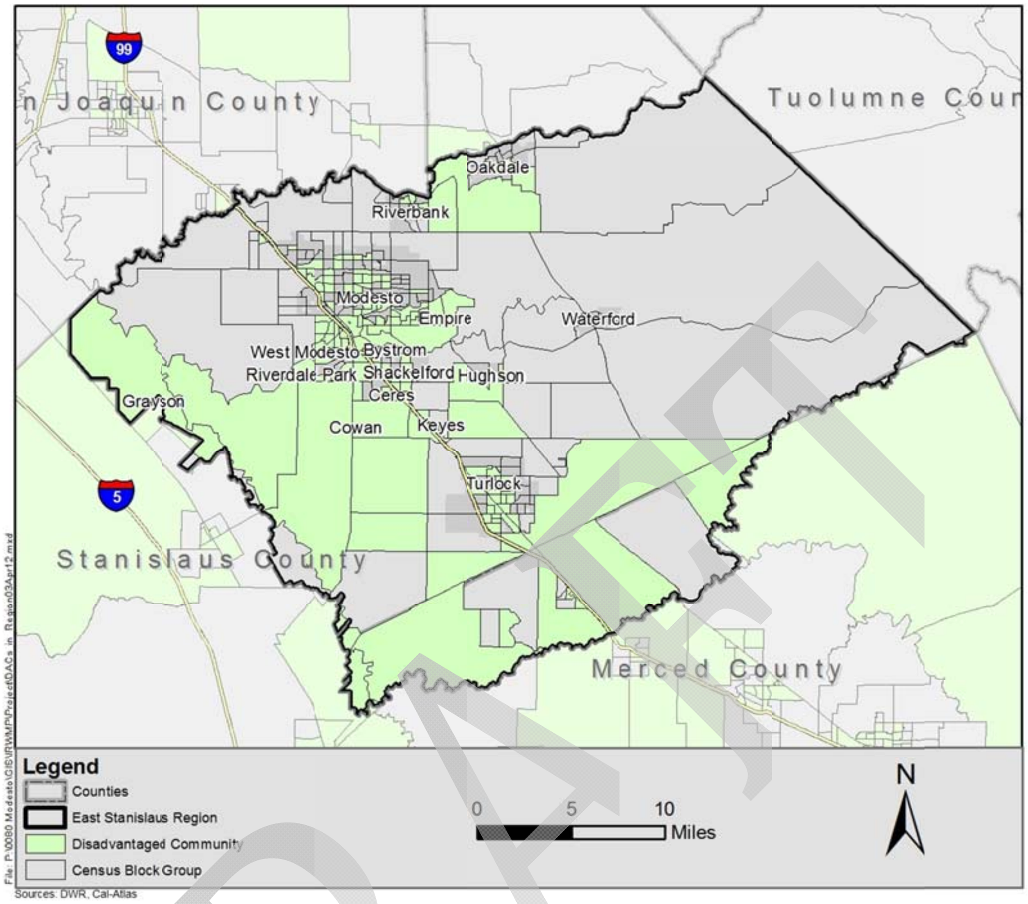


Table 2-8: DACs in the East Stanislaus Region

Community[1]	MHI
Bret Harte	$38,087
Bystrom	$34,464
Cowan	$31,063
Empire	$32,198
Grayson	$39,567
Keyes	$35,130
Parklawn	$32,902
Riverdale Park	$37,656
Rouse	$30,504
Shackelford	$19,302
West Modesto	$30,767

1. Based on the ACS data for Census Designated Places.
2. Source: DWR ACS data from 2006 to 2010, available here: http://www.water.ca.gov/irwm/grants/resourceslinks.cfm.

2.2 Water Resource Status

2.2.1 Water Supplies and Demands

The Cities of Modesto, Turlock, and Ceres have each prepared a 2010 Urban Water Management Plan (UWMP). The City of Hughson is not considered an urban water supplier (as they deliver less than 3,000 AFY) and therefore is not required to prepare an UWMP.

The 2010 UWMPs prepared were updates to each city's 2005 UWMP and were prepared in compliance with the Urban Water Management Planning Act, which was originally established by Assembly Bill 797 in 1983. The law requires water suppliers who provide water to more than 3,000 customers or supply more than 3,000 AFY to prepare and adopt an UWMP every five years. In 2009, Senate Bill x7-7 (SBx7-7), also referred to as the Water Conservation Act of 2009, was passed which required each urban water supplier to include in the 2010 UWMP per capita water use targets to be met by 2015 and 2020. The statewide objective of SBx7-7 is to reduce per capita water use by the year 2020 by 20%. The water demand projections each city developed for inclusion in its UWMP assume the 2020 urban water use targets will be met. Water supplies and demands for each city are described in the following sections. This section includes the demand information/projections that are currently available. Some water demands, such as the agricultural demands, are not currently publicly available and therefore are not included in this description.

City of Modesto

The City of Modesto is the largest retail water supplier in Stanislaus County and has been providing potable water service to its urban area since 1895 through the acquisition/purchase of multiple water companies. Until 1995, the sole water supply source was groundwater from the Modesto and Turlock Groundwater Subbasins.

In the early 1990s, the City of Modesto, MID, and the former Del Este Water Company formed a partnership to use a portion of MID's surface water supplies for municipal uses, resulting in the Modesto Domestic Water Project (MDWP). The MDWP includes a 30 mgd surface water treatment plant plus storage and delivery facilities. The surface water treatment plant, referred to as the Modesto Regional Water Treatment Plant (MRWTP), and the associated facilities were completed in January 1995 and the City started delivery of treated surface water in addition to groundwater. In July 1995, the City of Modesto acquired the Del Este Water Company.

The City of Modesto's service area includes one large contiguous area and several outlying, non-contiguous areas. The service area is shown in Figure 2-9. The contiguous portion of the service area consists of the City's current sphere of influence (SOI), Salida, North Ceres and some unincorporated Stanislaus County "islands." The non-contiguous portion of the service area includes Grayson, Hickman, Del Rio, Waterford, a part of north Ceres, and portions of Turlock.

Approximately 264,000 people within the service area received water services from the City of Modesto. Historically, the City has been among the fastest growing areas in the State of California. Beginning in 2007, growth began slowing at a significant rate due to the economic downturn. The service area population of 264,000 is approximately 20,000 less than what was projected for 2010 in the City's joint 2005 UWMP with MID. The 2010 Joint (Modesto and MID) UWMP assumes a growth rate of 1.9% with an estimated population of 375,000 in 2030. Projected water demand is presented in Table 2-9.

Table 2-9: City of Modesto Projected Water Demand, AFY [a]

2010 (actual)	2015	2020	2025	2030	2035
64,464	82,900	80,500	87,900	96,000	104,800

Source: West Yost, 2011b. Table ES-1.
Footnotes:
a. Includes unaccounted for water which is estimated to be about 15% of total production.

As previously noted, the City of Modesto relies on conjunctive use to meet demands with its water supplies from two sources – groundwater and Tuolumne River surface water that is purchased wholesale from MID. Groundwater and surface water will continue to be the primary sources of water for the City, and although the City is pursuing recycled water, it would be to provide a more reliable and cost-effective water supply for agricultural use rather than to act as a potable water offset. The MRWTP provides water to municipal customers within the City of Modesto city limits north of the Tuolumne River, including the communities of Salida and Empire, while the customers south of Tuolumne River in the Turlock Irrigation District (TID) service area are served by groundwater from both north and south of the river.

In 2010, the City of Modesto pumped 33,800 AFY with groundwater constituting 52% of the City's total water supply. In the future, groundwater pumping is expected to be reduced with the expansion of surface water supplies with the implementation of the MRWTP Phase 2 (anticipated to be completed in 2015). The City of Modesto currently has 33,602 AFY in available treated surface water supplies from MID. In 2010, the City purchased 30,647 AFY of additional surface water from MID. Once the MRWTP Phase 2 is operational, available treated surface water from MID will increase up to 67,204 AFY, adding to the City of Modesto's water supply and replacing some groundwater pumping. Anticipated future water supplies are shown in Table 2-10.

Table 2-10: City of Modesto Current and Future Water Supplies, AFY

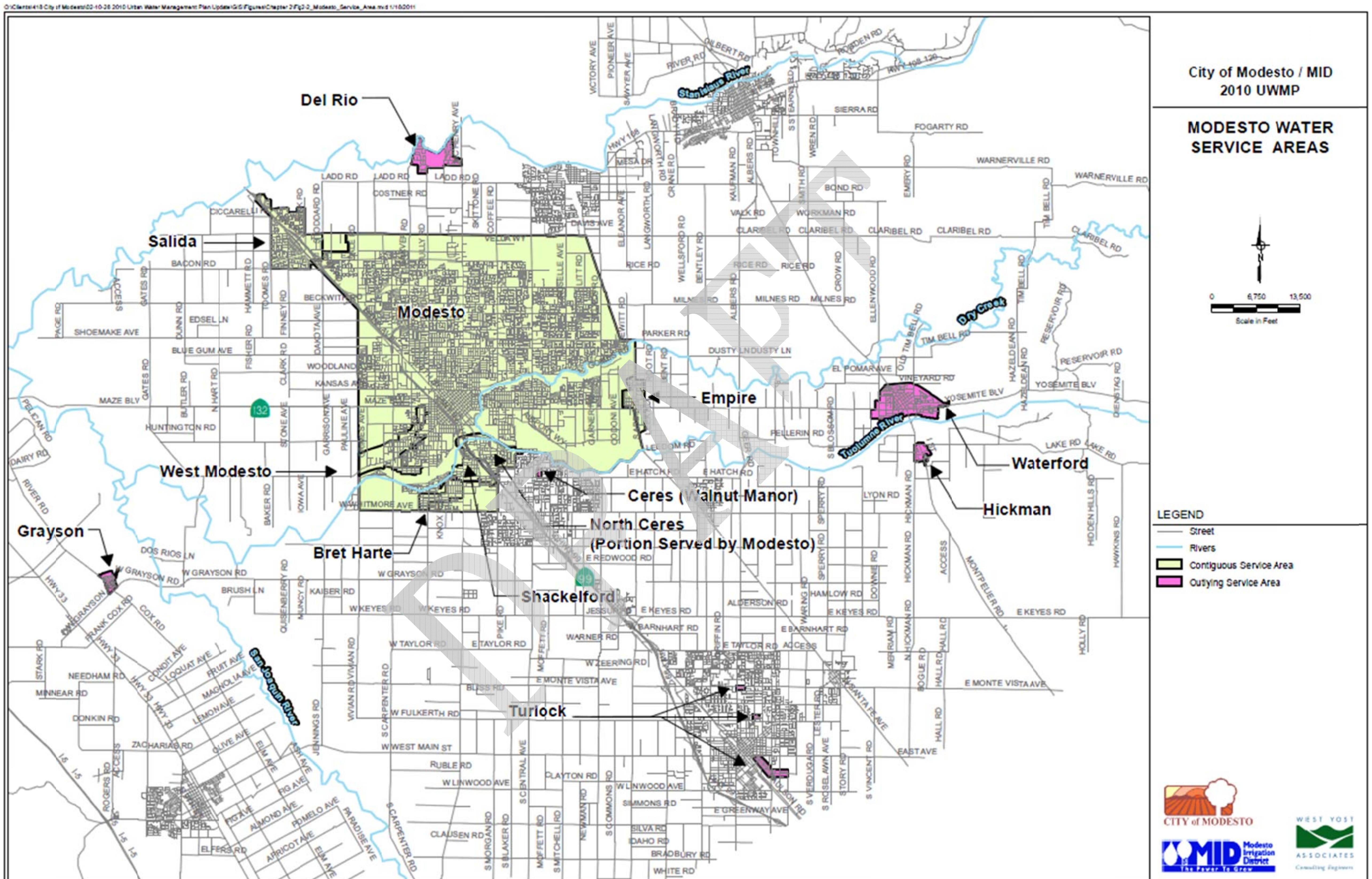
Supply	2010 (actual)	2015 [a]	2020	2025	2030	2035
Surface Water (Purchased from MID)	30,647	67,200	67,200	67,200	67,200	67,200
Groundwater	33,817	15,700	13,300	20,700	28,800	37,600
Total	64,464	82,900	80,500	87,900	96,000	104,800

Source: West Yost, 2011b. Table ES-2.
Footnotes:
a. In late 2015, when the MRWTP Phase 2 is completed, an additional 33,602 AFY of demand will be met with treated surface water supplies.
b. Build-out demand for the Modesto Water Service Area is 104,800 AFY which includes the anticipated reductions in water use to comply with SBx7-7.

The City of Modesto may also participate in a potential third phase of the MRWTP and/or the Regional Surface Water Supply Project (RSWSP), a proposed project to provide treated surface water for municipal use in South Modesto. Either project would result in greater supplies of treated surface water from MID and TID, respectively. The Stanislaus Regional Water Authority is pursuing the Regional Surface Water Supply Project. TID would provide raw surface water to the Authority to treat and sell to the three participating cities (Turlock, Modesto, and Ceres). Hughson may purchase treated water from the Authority, but that would be determined during a potential future phase of plant expansion.

The City of Modesto has adequate water supplies to meet projected water demands through 2035 during all hydrologic conditions. Other water supply options (such as desalination) for the City of Modesto are not necessary nor are they economical (West Yost, 2011b).

Figure 2-9: City of Modesto Water Service Area



Source: West Yost, 2011b.

Modesto Irrigation District

In 1887, MID was formed as the second irrigation district in California (after TID), and predominantly provides agricultural irrigation water from the Tuolumne River and the underlying groundwater basin. Surface water is diverted from the Tuolumne River at La Grange Dam, constructed in 1893 to divert water to MID north of the river and to TID south of the river. Don Pedro Reservoir is the District's primary water storage facility, while Modesto Reservoir is a small holding reservoir. The MID service area is shown in Figure 2-10.

MID is primarily an agricultural water supplier and provides irrigation water to 57,000 acres, typically between mid-March and late October each year. MID can also serve approximately 9,000 acres of additional lands based on customer demands. This water is used for dairy, chickens, turkeys, cattle, almonds, grapes, walnuts, tomatoes and peaches. In summary, MID serves approximately 3,000 irrigation accounts with an average of 20 acres per account. As previously noted, MID also provides treated surface water to the City of Modesto for domestic delivery, but it does not directly serve any domestic water users. In 1992, when MID, the City of Modesto, and the former Del Este Water Company formed a partnership, the agencies signed the *Treatment and Delivery Agreement Among the Modesto Irrigation District, City of Modesto, and Del Este Water Company* which controlled the delivery of domestic treated water from MID to the City of Modesto. This agreement obligated MID to deliver up to 33,602 AFY (30 mgd) to the City of Modesto each year (May 1st through April 30th), during normal years. The agreement contains a formula to determine reductions of water supplies during dry years. In September 2005, the SWRCB approved a long-term transfer of 67,204 AFY of water from MID to the City of Modesto through the year 2054. In October 2005, the original 1992 agreement was amended to include the second phase of the MRWTP (an additional 30 mgd) (West Yost, 2011b).

MID distributes a combination of Tuolumne River water and groundwater via a network of storage facilities, canals, pipelines, pumps, drainage facilities and control structures. The District operates approximately 90 groundwater wells with a combined pumping capacity of approximately 250 cubic feet per second (cfs) (MID, 2012). MID, in conjunction with TID, also operates the New Don Pedro Reservoir with a maximum storage capacity of 2,030,000 AF. Together, the Districts are responsible for maintaining regulated fish flows in the Tuolumne River to comply with FERC licensing requirements. MID's median annual diversion is 315,756 AF (MID, 2012). Of that amount, approximately 35,000 AF is diverted to the MRWTP for treatment and delivery to the City of Modesto (MID, 2012).

The MID on-farm water delivery system was originally designed to deliver irrigation water by gravity, with very large flows (10-20 cfs) on a predetermined rotation (typically every 10-20 days). However, as irrigators have converted their on-farm application practices from flood to pressurized systems, the requests for irrigation water have shifted from rotation to arranged-demand (MID, 2012). MID has an irrigation water allocation policy which established the allocation and cost of water to landowners. Factors affecting water allocation include land within the service area, reservoir storage, riparian rights, water year type, amount of land owned, and predicted runoff (MID, 2012). MID uses a variety of devices and methods to measure water within its delivery system (including orifices, propeller meters, weirs, flumes, venture meters and pumps), and it has a water rate schedule based on budget requirements and board policy. MID's water rates are an increasing block rate (tiered) pricing structure for water users who exceed the base amount of allocated water. The block rate structure is established annually, but typically contains two to three blocks of water with increasing price rates (MID, 2012).

As the developed areas of the City of Modesto and other communities within the MID service area expand, irrigated land is being replace by urban land uses. This continuing shift in land uses drives projected changes in water use. MID delivered 30,034 AF of treated water to the City of Modesto in 2009 (MID, 2012). The joint UWMP produced by MID and the City of Modesto projects that this supply will increase to 67,200 AFY by 2015 and remain constant until 2035. Future changes in agricultural water use will be driven by changes in cropping, irrigation practices, climate change and fluctuations in Tuolumne River hydrology. Although the irrigated area within the MID service area is expected to remain relatively stable, changes in the availability of surface water will continue to include the annual allocation of water (MID, 2012).

City of Turlock

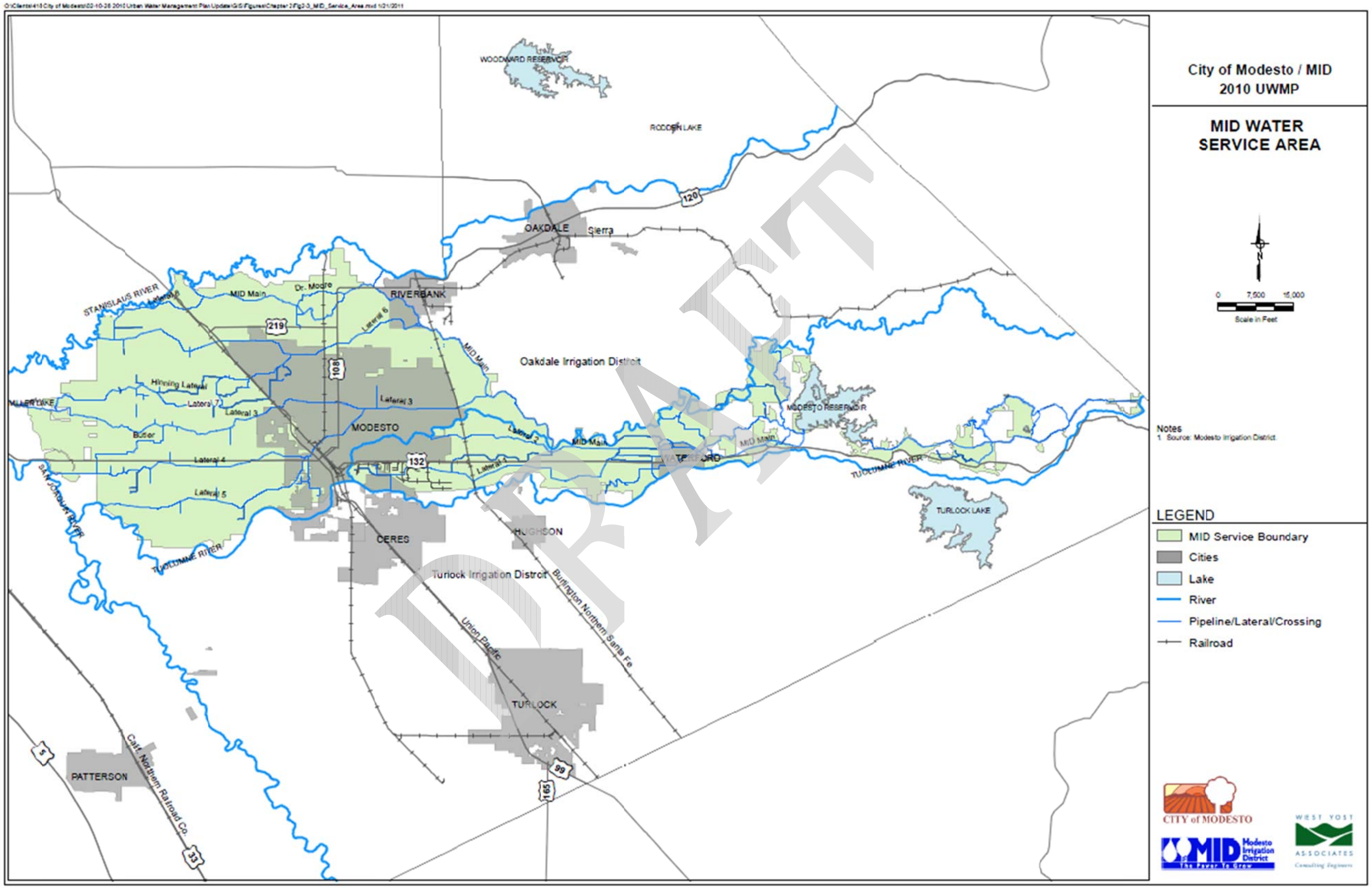
The City of Turlock is the second largest city in Stanislaus County, situated midway between Modesto (to the northwest) and Merced (to the southeast). The City of Turlock's population has grown steadily from 13,992 in 1970 to almost 70,000 in 2010. The City provides water to its service area through about 18,500 service connections. Turlock began installing water meters in 2007, and meter-based (i.e. volumetric) billing for all water users began on January 1, 2011. With the installation of water meters and volumetric billing, the recent drought, and the education/outreach efforts the City has implemented, there has been a significant reduction in water use. The City of Turlock's peak water use occurred in 2007 at 8,359 MG; in 2010 water use decreased to 7,093 MG.

The City of Turlock overlies the Turlock Groundwater Subbasin, a subbasin of the San Joaquin Valley Groundwater Basin. DWR's Bulletin 118 estimated a 160,000 AF increase of groundwater overdraft in this subbasin from 1990 to 1995, but from 1994 to 2000, groundwater water levels in the Turlock Subbasin rose about seven feet. The rising groundwater levels suggested that the groundwater basin had started to recover, but again, beginning in 2000, groundwater production increased, reaching its peak in 2007 when 8.359 billion gallons were pumped. Combined with below average rainfall, increased agricultural pumping and urbanization, groundwater pumping for urban water has adversely impacted groundwater levels. Conservation efforts and increase rainfall have helped the groundwater basin to begin recovering once again.

Groundwater is an unreliable water supply source for the City of Turlock in the long-term because the quantity that can be pumped depends on the amount available in the groundwater basin, the ability of the City's wells to pump, and pumping by other users. There is a significant cone of depression about five miles east of Turlock due to agricultural pumping; but even so, overdraft conditions have not occurred under the City of Turlock.

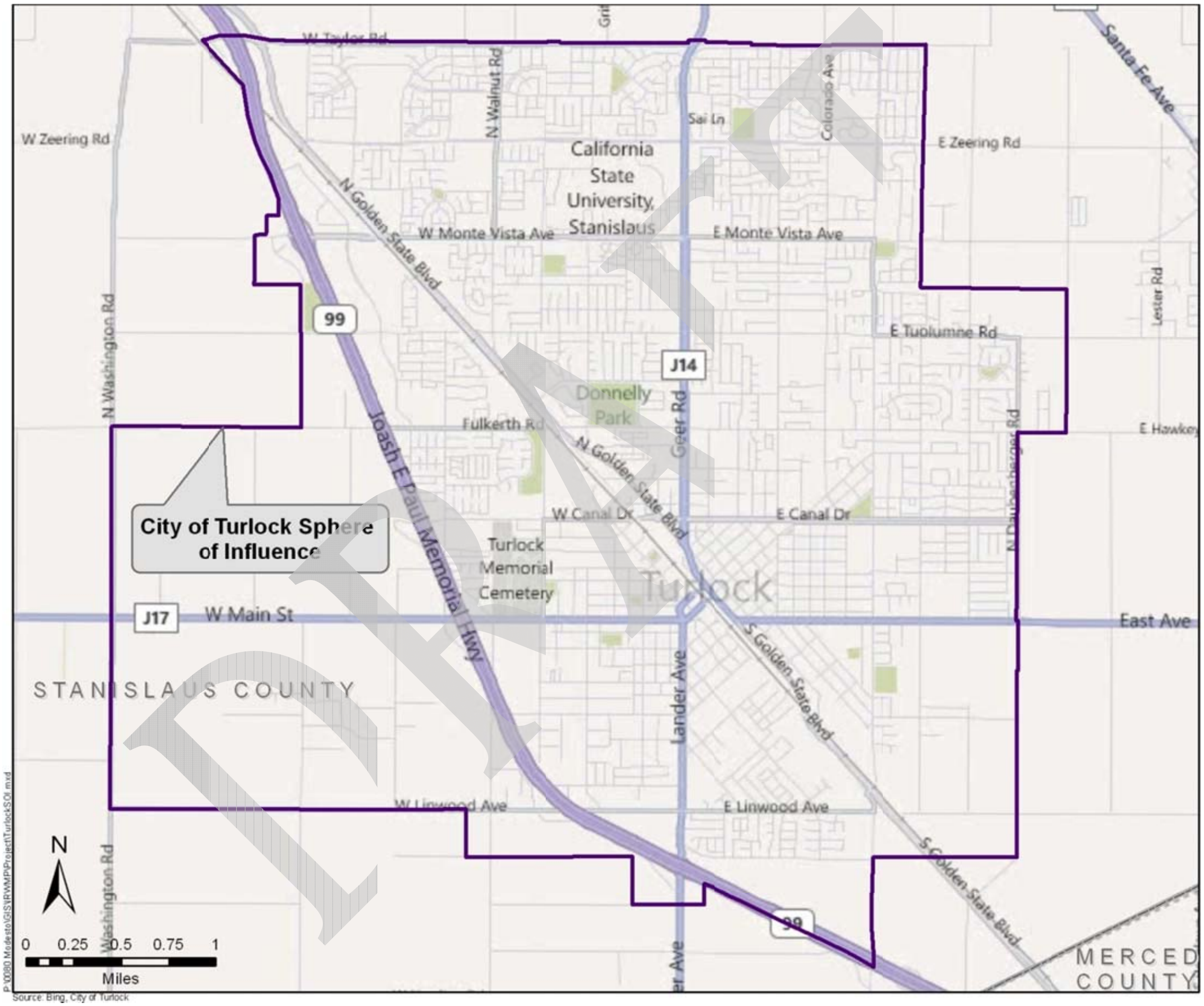
The City of Turlock's sole water supply is groundwater, and it anticipates meeting all water demands in its service area in the next five years with groundwater and supplementing supplies (recycled and non-potable water) as needed. As previously discussed, the City's wastewater treatment facility was recently upgraded to tertiary treatment, and the City is permitted to use the recycled water for industrial cooling and landscape irrigation at Pedretti Baseball Park. Water extracted from the shallow groundwater aquifer typically does not meet drinking water standards, but it can be used for landscape irrigation. Also, the City uses excess runoff from residential watering to supply irrigation water to Summerfaire Park. Potable water from the groundwater basin can support annual production of up to 8 billion gallons per year.

Figure 2-10: MID Service Area



Source: West Yost, 2011b.

Figure 2-11: City of Turlock Water Service Area



A population growth rate of 2.5% was used to estimate future water demand in the City of Turlock's service area in its 2010 UWMP. The demand projections are based on the preferred land use plan outlined in the Draft *2030 City of Turlock General Plan Update*. Table 2-11 presents current and projected future water demands for the City of Turlock.

Table 2-11: City of Turlock Water Demand, AFY [a]

2010 (actual)	2015	2020	2025	2030	2035
21,768	26,957	29,280	33,129	37,216	42,108

Source: City of Turlock, 2011. Tables 4 through 7.
Footnotes:
a. Does not include recycled water Turlock delivers to TID for industrial cooling or recycled water used for irrigation.

The City of Turlock intends to enter into an agreement with TID for delivery of 16,802 AFY of TID surface was to the City. TID has acknowledged that this volume of water is available and, for planning purposes, it expected to be available in 2020. Therefore, current and future water supplies for the City of Turlock are shown in Table 2-12.

Table 2-12: Current and Project Water Supplies, AFY

Water Supply Source	2010	2015	2020	2025	2030	2035
Water Purchased from TID [a]	0	0	16,802	16,802	16,802	16,802
Groundwater	21,771	26,957	12,478	16,327	20,414	25,306
Recycled Water	1,129	1,228	1,228	1,228	1,228	1,228
Total	22,900	28,185	30,508	34,357	38,444	43,336

Source: City of Turlock, 2011. Table 16.
Footnotes:
a. Assumes the TID's surface water treatment plant (the RSWSP) will be operational in 2020.

Turlock Irrigation District

Turlock Irrigation District (TID) was established in 1887 as the first publicly owned irrigation district in the State. Organized under the Wright Act, the District operates under provisions of the California Water Code as a special district. At present, TID covers a service area of 197,261 gross acres, with 157,800 acres that can currently be irrigated with surface water (TID, 2012). TID services over 4,900 irrigation customers, with irrigation water used to grow alfalfa, almonds, beans, corn, grapes, grain, oats, peaches, sweet potatoes and walnuts. The Tuolumne River is the District's primary source of water. Water for irrigation and hydroelectric power generation is kept at Don Pedro Reservoir, about 50 miles east of the Turlock.

The TID irrigation service area is generally bounded on the north by the Tuolumne River, on the south by the Merced River, and on the west by the San Joaquin River. The communities of Turlock, Ceres, Keyes, Denair, Hughson, Delhi, South Modesto, Hickman, and Hilmar are within the boundaries of the TID irrigation service area. As previously noted, the Tuolumne River is the principal water supply for TID, although the District does supplement surface water supplies with drainage wells and rented wells and jointly operates New Don Pedro Reservoir with MID. Rented wells are private or Improvement District wells that are rented by TID to supplement irrigation supplies, especially in dry years (TID, 2012).

In addition to La Grange Dam, the District's diversion dam, and Don Pedro Reservoir (its storage reservoir), TID owns and maintains more than 250 miles of canals and laterals, about 90% of which are concrete-lined to curb seepage and erosion. TID typically delivers irrigation water between mid-March and mid-October of each year. Customers irrigate their lands through a variety of means, including flood irrigation, drip and micro systems.

TID works cooperatively with other local agencies to promote the long-term sustainability of its water supplies. TID actively manages its groundwater supplies conjunctively with its surface water supplies, and participates in local groundwater management and planning. The District has a long-standing program of groundwater level monitoring and cooperates with other state and local entities to monitor the larger Turlock Subbasin area. TID is a member of the Turlock Groundwater Basin Association and has adopted the Turlock Groundwater Management Plan.

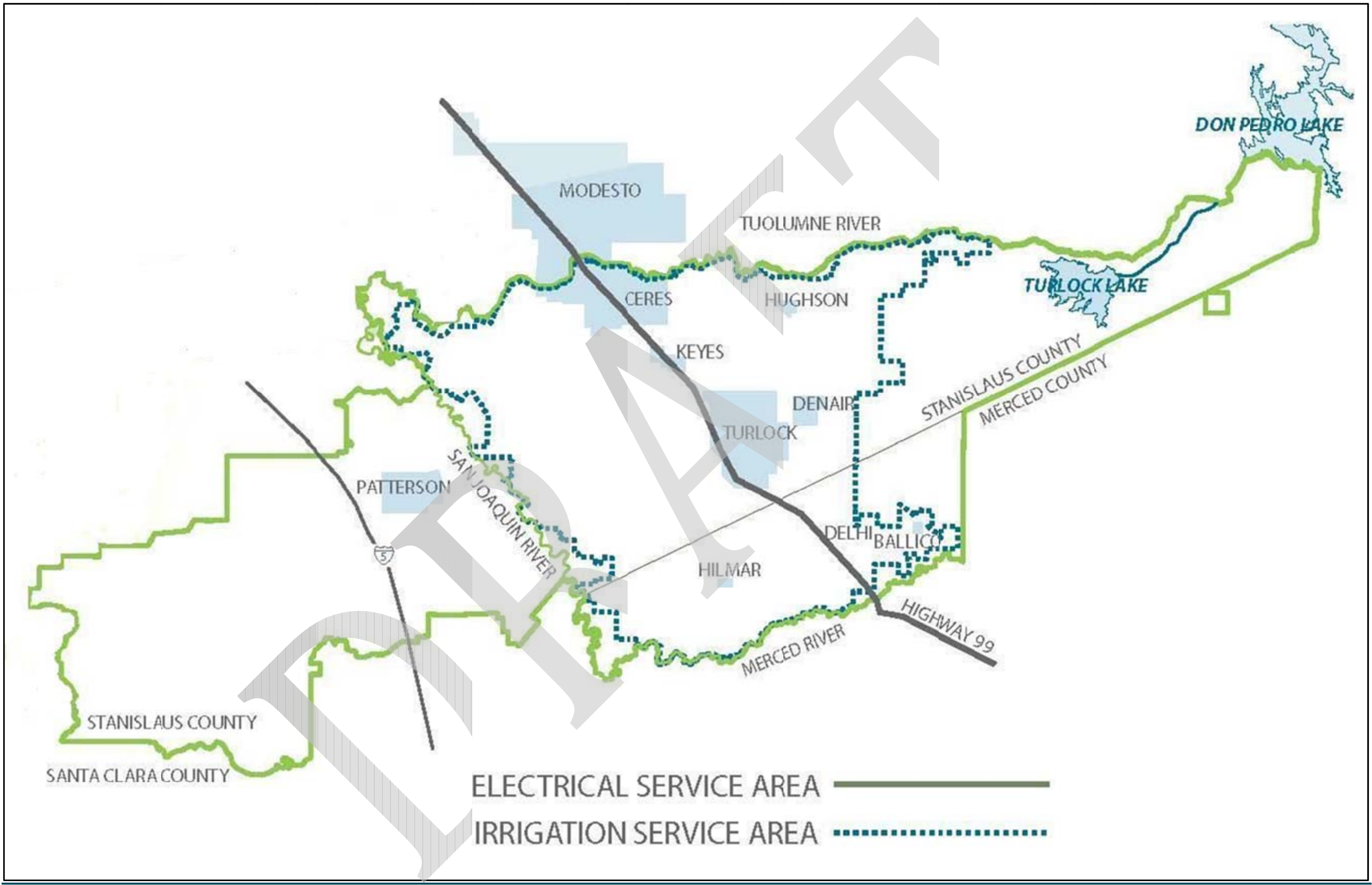
In 1996, TID was one of the first to develop an Agricultural Water Management Plan (AWMP) as a member of the Agricultural Water Management Council (AWMC), a non-profit organization consisting of water suppliers, public agencies, and members of the farming, academic and environmental communities. In compliance with new laws regarding Agricultural Water Management Planning, TID adopted an updated AWMP at the end of 2012 and remains committed to developing and implementing sound planning practices through its AWMP and to continue support agricultural irrigation efficiency.

TID uses a restricted arranged demand system of water ordering and delivery. Water deliveries are measured by a combination of SCADA, pressure transducers, sidegates, velocity meters, and electrical usage data. The TID Board of Directors establishes baseline water allotments each year, depending on projected runoff and including the possibility of the occurrence of consecutive dry years, carryover storage, flows required to be delivered to the lower Tuolumne River, and the availability of rented pumps. In addition, the TID Board of Directors has adopted a new volumetric pricing structure which utilizes a three-tiered increasing block rate structure combined with a fixed charge.

In recent years, several local community water systems, including those in Hughson, Ceres, Turlock and the southern portion of Modesto, have been studying the possibility of using TID surface water from the Tuolumne River to supplement urban groundwater supplies. While such a project would be within current irrigation boundaries, it would result in resumed water service to those areas (TID, 2012).

Over the last five years, total TID water supply averaged about 614,000 AF, approximately 82% from surface water, 16% from groundwater and 2% from other supplies such as subsurface drainage, tailwater, spill recovery, and recycled wastewater (TID, 2012).

Figure 2-12: TID Service Area



City of Ceres

The City of Ceres provides water to almost all residential, commercial, industrial and institutional (CII) users, and governmental water users within its city limits. The City of Ceres water service area is concurrent with the city limits, except in the northwest portion of the city where the City of Modesto serves water to approximately 1,200 customers. The City of Ceres also serves some customers outside its city limit, but within its primary sphere of influence (SOI). The City's water service area is shown in Figure 2-13.

Since 1992, the City of Ceres has been installing water meters on all new residential units. In 2012, the City completed installation of meters on pre-1992 residential connection, multi-family housing, and CII users, and established rates for volumetric billing. Additionally, the City installed an Advanced Metering Infrastructure (AMI) system which includes fixed infrastructure to collect meter information. A metered rate structure was implemented to encourage conservation of water. The City of Ceres' future water demands are driven by compliance with SBx7-7 and the associated urban water use reductions. The City's projected water demands are presented in Table 2-13.

Table 2-13: City of Ceres Projected Water Demands, AFY [a]

2010 (actual)	2015	2020	2025	2030	2035
8,284	10,700	12,300	14,800	17,300	19,800

Source: West Yost, 2011a. Table ES-1.
Footnotes:
a. Includes unaccounted for water, estimated to be 15% of total production in 2015; after 2015 it is assumed unaccounted for system losses decrease to 10%, accounting for improved leak detection and repair when the City is fully metered.

The City of Ceres' sole water supply source is groundwater pumped from the Turlock Subbasin. Since 1980, the City of Ceres' groundwater production has increased from 3,300 AFY to approximately 10,000 AFY. Anticipated future water supplies are presented in Table 2-14. Non-potable groundwater is also pumped from shallow wells and used to irrigate several parks within the City. The non-potable water that is pumped is not included in the groundwater estimates in Table 2-14.

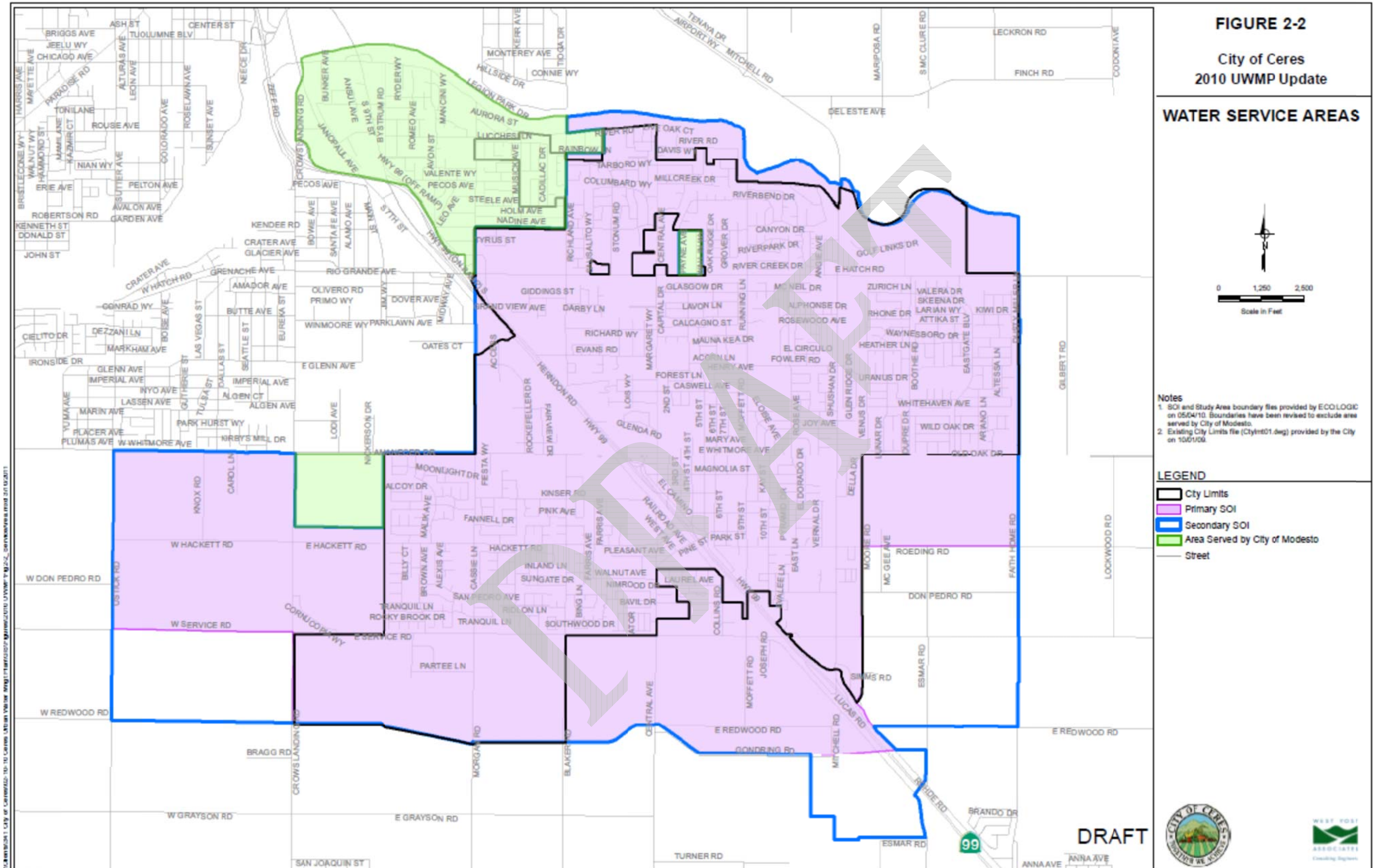
The City of Ceres is a member of the Stanislaus Regional Water Authority and is working with TID to implement the Regional Surface Water Supply Project (RSWSP) and supplement its current water supply with surface water. The City of Ceres future water supplies, shown below, assume the RSWSP is completed in 2018 and will supply the City with an additional 6 mgd.

Table 2-14: City of Ceres Future Water Supplies, AFY

Supply Source	2010 (actual)	2015	2020	2025	2030	2035
Groundwater [a]	8,284	10,700	5,600	8,100	10,600	13,100
TID Surface Water [b]	0	0	6,700	6,700	6,700	6,700
Total	8,284	10,700	12,300	14,800	17,300	19,800

Source: West Yost, 2011a. Table ES-2.
Footnotes:
a. Groundwater quantity calculated by subtracting future water demand from surface water supply amount.
b. The RSWSP is anticipated to be operational in 2018. 6,700 AFY will be provided to the City of Ceres.

Figure 2-13: City of Ceres Water Service Area



Source: West Yost, 2011a.

Because the City of Ceres' sole source of water supply is groundwater, it is vulnerable to climatic variability and water quality. The primary sources of groundwater recharge in the Turlock Subbasin are infiltration from the Tuolumne River and incidental recharge from applied irrigation water. Drought conditions can reduce groundwater recharge and during a multi-year drought, groundwater levels can decline. By diversifying the City's water supply portfolio and adding a second source of water, surface water from the RSWSP, overall water supply reliability will increase. The addition of surface water to the City's supply portfolio will help protect the groundwater basin from overdraft and water quality degradation. Surface water is expected to be even more vulnerable to climatic variations than groundwater, so the City of Ceres' water supply projections presented in Table 2-14 assume groundwater will continue to be the primary source of water (West Yost, 2011a).

City of Hughson

The City of Hughson provides potable water services to residential and CII customers in its service area. Currently, the sole water supply source for the City is groundwater extracted from the Turlock Subbasin using five groundwater wells. The City's existing water distribution system and water facilities are shown in Figure 2-14. Water is distributed to its customers through 20 miles of pressurized pipe. The City's five wells each have a minimum capacity of 1,000 gpm, up to a maximum of 1,200 gpm. The combined well capacity is 8.1 mgd, which is adequate to meet estimated future water demands under most scenarios. In January 2007, the City of Hughson prepared a Water System Master Plan (Carollo, 2007a) with the purpose of effectively planning for future growth and identified Capital Improvement Program (CIP).

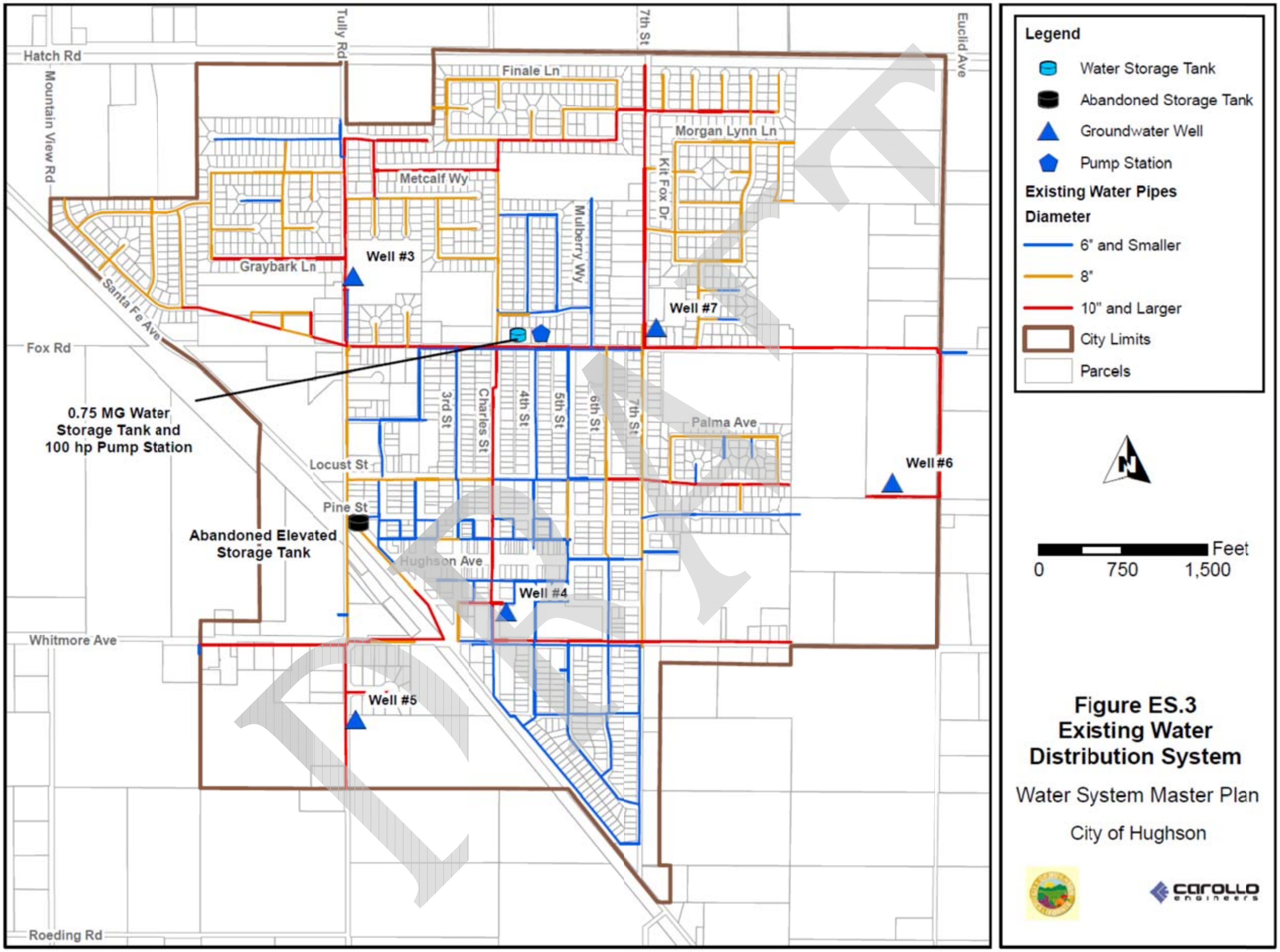
The annual average water production in 2005 for the City of Hughson service area was 541 MG or 1.5 mgd. This equates to an average daily per capita water use of about 250 gallons per capita per day (gpcd) (Carollo, 2007a). The City of Hughson's future water demands are shown below in Table 2-15. These demands are estimated based on the general plan land use and applied water demand factors. The City's updated General Plan was adopted in December 2005 and defines the City's land use plan at build out. Population is expected to increase from 5,942 (in 2005) to 15,074 (at build out in 2025), equating to an annual increase of 4.75%.

Table 2-15: City of Hughson Water Demand, AFY

2010	2015	2020	2025	2030
2,466	3,363	4,260	5,157	5,157

Source: Carollo, 2007a. Table ES.2.

Figure 2-14: City Hughson Water Service Area and Facilities



Source: Carollo, 2007a

Oakdale Irrigation District

Oakdale Irrigation District (OID) is located in Stanislaus and San Joaquin Counties, on the eastern side of the region. Approximately three-fifths of OID's service area lies south of the Stanislaus River and overlying the Modesto Groundwater Subbasin; this areas is within the East Stanislaus IRWM Region. The remaining two-fifths of the service area lies north of the Stanislaus River, overlying the Eastern San Joaquin Groundwater Subbasin.

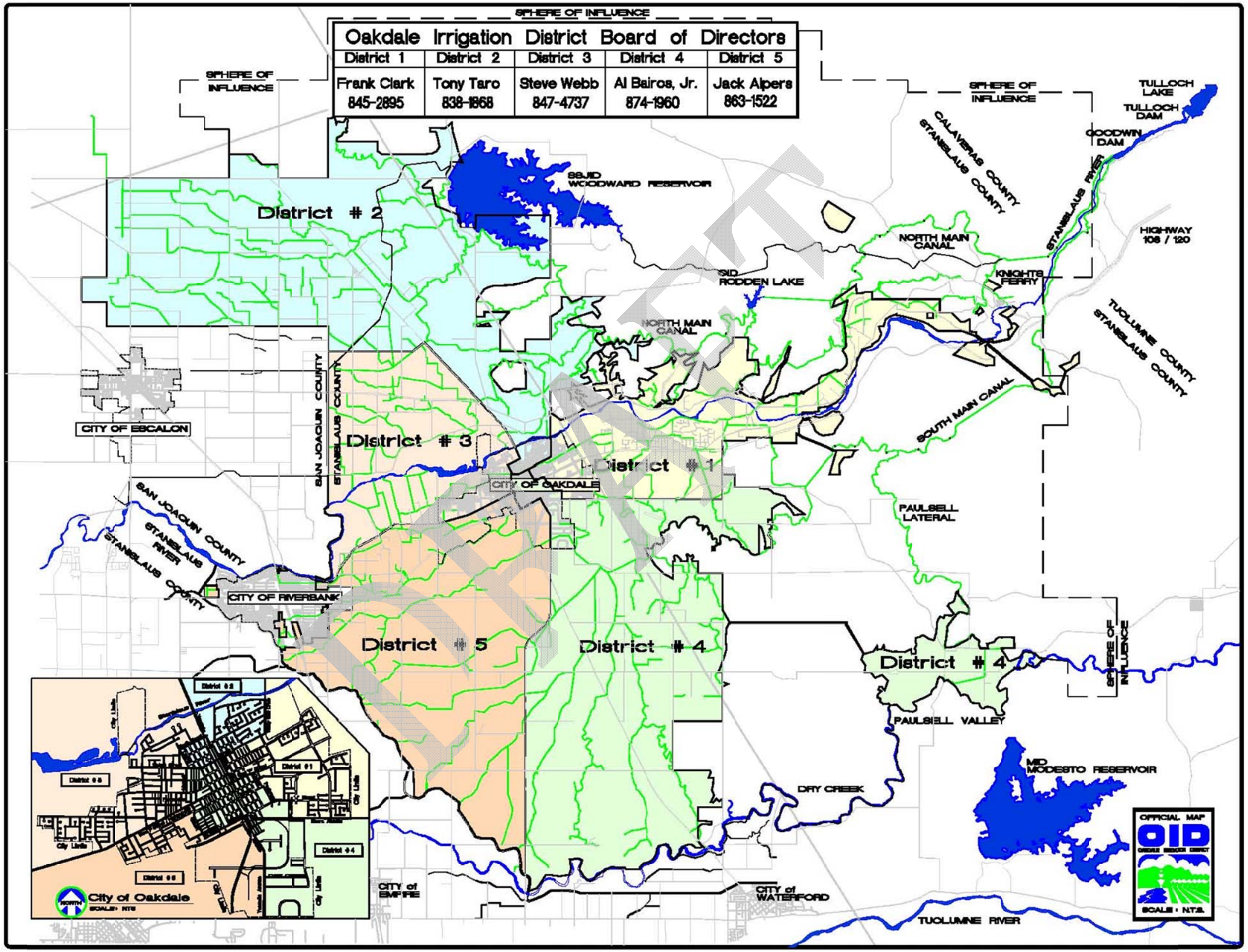
OID was formed in 1909, and in 1910, purchased certain Stanislaus River water rights and facilities from two existing water companies. Together with the South San Joaquin Irrigation District (SSJID), OID holds pre-1914 water rights for diversion of 1,817.7 cfs from the Stanislaus River at Goodwin Dam (Davids Engineering, 2012). In addition to Goodwin Dam, OID and SSJID also share a joint main canal, extending four miles from Goodwin Dam to the Joint Diversion Works. This canal carries 28% OID water and 72% SSJID water. OID's facilities also include main canals on each side of the river (the North Main Canal and the South Main Canal), plus approximately 250 miles of lateral and sublateral ditches.

Historically, OID shared Melones Reservoir (a storage reservoir) with SSJID, plus 25 deep wells used to augment water supply as needed. The Tri-Dam Project (jointly owned with SSJID and PG&E) was subsequently added. This project consists of three reservoirs with a combined storage capacity of 230,400 AF, plus combined power generation facilities capable of producing 81,000 KW of power. An additional 93,000 KW of generation capacity is provided by the Sand Bar Hydroelectric Powerhouse.

In 1979, New Melones Dam was completed, providing a reservoir capacity of 2.4 million AF and effectively submerging the original Melones project. New Melones Dam was constructed by the U.S. Army Corps of Engineers and transferred to the USBR; the dam and reservoir were subsequently incorporated into the Central Valley Project. Following completion, OID and SSJID entered into an operational agreement with the USBR allowing the District to divert a combined supply of 600,000 AF of water annually, subject to availability (OID, 2012). Releases from New Melones Dam are now the principal source of water for OID, along with groundwater from 25 operating wells. These wells produce an average of about 6,300 AFY. OID also operates 43 drainage and several reclamation pumps, used to discharge around 13,000 AFY. OID actively participates in groundwater management activities in the basins it overlies.

OID's service area currently encompasses approximately 72,345 acres of land supporting four major crop groups (irrigated pasture, oats/corn (double crop), rice, fruits/nuts) plus several rural communities (including the Cities of Oakdale and Riverbank, located within OID's service area). In addition, OID has short-term water transfers with the California American Water Company (Stockton District), and provides water to two rural water areas outside of the City of Oakdale. Water diverted from the Stanislaus River into the District's canals is measured by gauging stations operated by the Tri-Dam Authority. Releases from the canals to laterals are measured by various means, including pressure transducers, ultrasonic water level sensors, weir sticks, measuring tapes, Clausen rules and stilling wells with staff gauges. As with the other water districts, water rates are established annually by the Board of Directors, with water deliveries to OID customers on a flat rate, per-acre basis (OID, 2012).

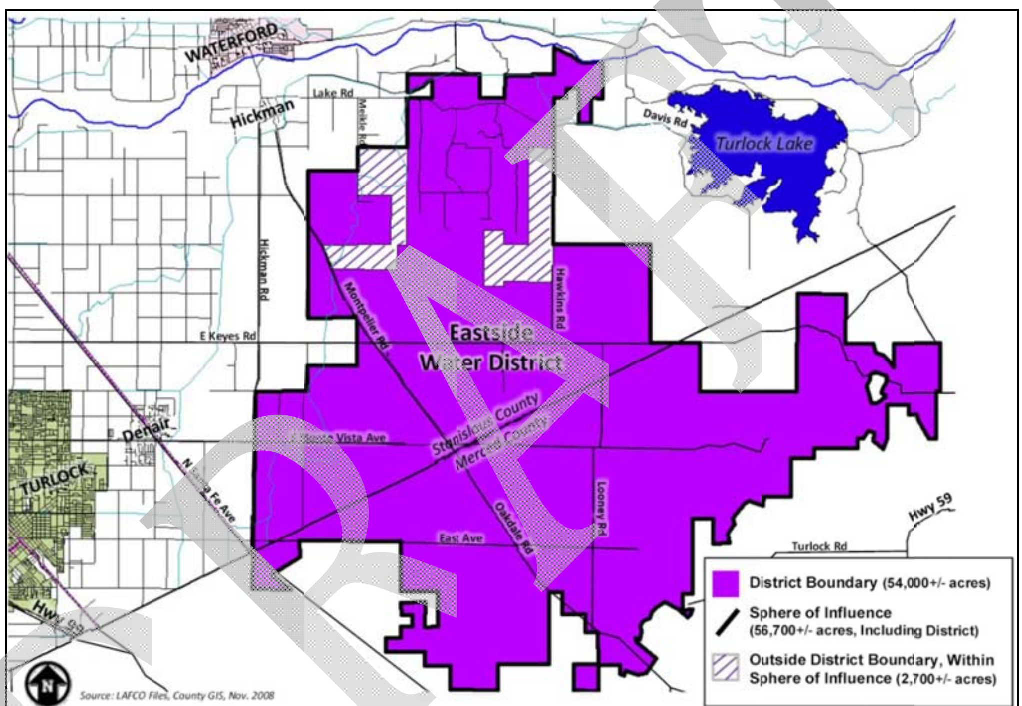
Figure 2-15: Oakdale Irrigation District Service Area and Facilities



Eastside Water District

Eastside Water District was formed in 1985 to address water needs in the area and encompasses approximately 54,000 acres in Merced and Stanislaus Counties. Most of the land within District is agricultural and is irrigated with groundwater; the District pumps on the order of 160,000 AFY. The only other source of supply is a very limited amount of surface water (~2,000 AFY) from purchases in wet years from the Turlock and Merced Irrigation District's canals lying adjacent to District and from riparian water rights along the Tuolumne and Merced Rivers. Groundwater within District appears to be declining at about two feet per year, creating an average annual deficit of about 80,000 acre-feet. The District participates in local groundwater management along with other users of the underlying Turlock Subbasin, and is actively working towards rectifying the basin overdrafts.

Figure 2-16: Eastside Water District



Demands and Supplies Outside Established Public Service Areas

There are areas within the East Stanislaus Region that are located outside the service areas of the afore-mentioned public water agencies. These areas are dependent primarily on groundwater for their water supplies. Privately-owned properties are managed by the individual property owner who also determines the water supply use, irrigation method, cropping patterns, and other issues related to their land. Unless a permit is acquired to install a building or well, modifications on the land are not part of a larger land use planning process. Privately-owned irrigation supply wells and domestic wells have been installed throughout the Modesto and Turlock Groundwater Subbasins to provide water for irrigation and supplies to rural homes and businesses. In addition to areas located outside of the local water agency boundaries that are using groundwater, there are also areas that have had significant conversions from non-irrigated lands to irrigated lands, further increasing reliance upon groundwater (TGBA, 2008).

Possible Future Changes to Water Supplies

In December of 2012, the SWRCB issued its *Public Draft, Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality*. In this document, the SWRCB evaluated potential impacts from proposed amendments to the 2006 *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (2006 Bay-Delta Plan). The amendments would establish:

- New flow objectives on the Lower San Joaquin River and its three eastside tributaries, the Tuolumne, Stanislaus and Merced Rivers (all of which are located within the East Stanislaus IRWM Region), for the protection of fish and wildlife beneficial uses; and
- New water quality (salinity) objectives for the protection of agricultural beneficial uses in the southern portion of the Sacramento-San Joaquin Delta (Delta).

The San Joaquin River flow proposal would establish February through June flow requirements of 35% of unimpaired flow for the three salmon-bearing tributaries. (Unimpaired flow is the flow that would occur if all runoff from the watershed remained in the river, without storage in reservoirs or diversions.) Achieving this proposal would require increased flows of 21% and 20% in the Tuolumne and Merced Rivers, respectively, with the increased flows resulting from decreases in diversions of 132,000 AFY from the Tuolumne River and 67,000 AFY from the Merced River. Loss of these diversions would significantly impact water supplies in the East Stanislaus Region. The proposed amendments are currently under consideration.

Concurrently, expansion of the San Joaquin River National Wildlife Refuge is being considered. As described in the Draft Environmental Assessment, released in 2012, the proposed expansion would add up to 22,156 acres of land to the Refuge. This expansion may require additional water to establish and maintain riparian habitats.

2.2.2 Water Quality

Water quality within a watershed can be affected by a mix of point and nonpoint source discharges, and groundwater and surface water interactions. Water quality can affect water supplies for the East Stanislaus Region and overall water supply reliability. Much of the Region relies predominantly on groundwater and/or surface water. In California, the SWRCB and the RWQCBs are responsible for contributing to the development of a Strategic Plan for water resource protection. In December 2002, the Central Valley Regional Water Quality Control Board (CVRWQCB) prepared a Watershed Management Initiative (WMI) chapter for its watersheds to integrate surface and groundwater regulatory programs. It was then revised in October 2004. The CVRWQCB divided its region into the Sacramento River Basin, the San Joaquin River Basin, and the Tulare Lake Basin (CVRWQCB, 2004). As previously described in Chapter 2.1.2, the East Stanislaus Region is within the San Joaquin Basin which is then further divided into the Merced, Tuolumne, and Stanislaus watersheds.

Each RWQCB is also required to prepare a Basin Plan (also referred to as a Water Quality Control Plan) to be used as a basis for regulatory actions to protect water quality. The Basin Plans describe beneficial uses, identify water quality objectives, and define an implementation program consisting of actions to be taken to meet those objectives. Region 5, the Central Valley Region, has two Basin Plans, one for Tulare Lake Basin and one for the Sacramento and San Joaquin River Basins. The latter Basin Plan is pertinent to the East Stanislaus Region and was originally adopted in 1975, then updated and revised in 1984, 1989, 1994, 1998 and 2011 (CVRWQCB, 2011).

Beneficial uses of water resources as identified in the Basin Plan are critical in water quality management. The existing and potential beneficial uses of the surface waters within the East Stanislaus Region include:

- Municipal and Domestic Supply
- Cold Freshwater Habitat
- Migration of Aquatic Organisms
- Spawning, Reproduction, and/or Early Development
- Hydropower Generation
- Recreation
- Freshwater habitat
- Wildlife Habitat
- Agricultural Supply

Beneficial uses of groundwater identified in the Basin Plan for groundwater in groundwater basins underlying the East Stanislaus Region include:

- Municipal and Domestic Supply
- Agricultural Supply
- Industrial Service Supply (e.g. cooling water supply)
- Industrial Process Supply (CVRWQCB, 2011)

Surface Water Quality

Pesticides have been found within the San Joaquin River at concentrations that are toxic to sensitive aquatic organisms. Two multi-year studies were conducted; one study in the early 1990's found a 43-mile reach of the San Joaquin River, between the confluence of the Merced and Stanislaus River, to be toxic about half of the time to invertebrate components of the U.S. Environmental Protection Agency (USEPA) three species test. This portion of the river is the portion within the East Stanislaus Region as the Stanislaus River coincides with the northern regional boundary and the Merced River coincides with the southern regional boundary. The toxicity in the river was caused by pesticides, specifically diazinon and chlorpyrifos, in storm and irrigation runoff from crops. A year later, follow-up testing was conducted that found that water in the San Joaquin River was toxic to invertebrate species about 6% of the time. As with the first study, diazinon and chlorpyrifos in winter storm runoff from crops and summer irrigation return flows were identified as the primary source of the toxins. Urban runoff has also been identified as a significant source in and around the City of Modesto. The SWRCB has also found elevated levels of Group A Pesticides in fish in the Tuolumne, Merced, and Stanislaus Rivers and the main stem of the San Joaquin River. Group A Pesticides include chlordane, toxaphene, endosulfan, and other pesticides, many of which are no longer used or are heavily regulated. These chemicals tend to bind to sediment and move into water systems as sediment moves off site (CVRWQCB, 2004). The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are on the Clean Water Act 303(d) list for Group A pesticides and various other constituents.

Water quality objectives were identified in the Basin Plan for inland surface waters and groundwater in the San Joaquin Basin. Examples of these objectives are as follows:

- Bacteria – In waters designated for contact recreation, the fecal coliform concentration shall not exceed a geometric mean of 200/100 milliliter (mL) from five samples over a 30-day period, nor shall more than 10% of the total number of samples taken during the 30-day period exceed 400/100 mL.

- Chemical Constituents – Water shall not contain chemical constituents in concentrations that adversely affect beneficial uses. For domestic and municipal water supply, the concentrations of chemical constituents must not be in excess of the maximum contaminant levels (MCLs) specified in the California Code of Regulations, and state and federal drinking water regulations.
- Color – Water shall be free of discoloration that adversely affects beneficial uses.
- Floating Materials, Oil and Grease – Water shall not contain floating materials, oils, greases, waxes or other materials that cause nuisance or affect beneficial uses.

Other water quality objectives were identified in the categories of biostimulatory substances, dissolved oxygen, mercury, methylmercury, pH, pesticides, radioactivity, salinity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity. A more comprehensive description of the water quality objectives is included in the Basin Plan. (CVRWQCB, 2011).

The SWRCB is also in the process of updating the *Water Quality Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary* (Bay-Delta Plan). The Bay-Delta Plan was developed in 2006 to protect water quality in the region and includes water quality objectives to protect municipal and industrial, agricultural, and fish and wildlife beneficial uses. The Delta Stewardship Council (DSC), as part of the Bay-Delta Plan, directed the SWRCB to adopt and implement updated flow objectives for the Sacramento–San Joaquin Delta (Delta) to achieve the coequal goals of ecosystem protection and a reliable water supply by June 2, 2014. To implement this policy, the Bay-Delta Plan is being updated by the SWRCB through a phased process. As part of Phase 1, a draft Substitute Environmental Document (SED) was prepared in December 2012 in support of potential changes to San Joaquin River flow and southern Delta water quality objectives and an implementation program to be included in the Bay-Delta Plan. The SED proposes to balance the use of water for fishery protection against competing uses of water such as municipal, agricultural, and hydropower. Amendments to the 2006 Bay-Delta Plan will establish the following:

- **Flow Objectives** – New flow objectives on the Lower San Joaquin River (LSJR) and its three eastside tributaries (the Stanislaus, Tuolumne and Merced Rivers) for the protection of fish and wildlife beneficial uses.
- **Water Quality Objectives –** New water quality (salinity) objectives for the protection of agricultural beneficial uses in the southern portion of the Delta.
- **Implementation Program –** An implementation program to achieve those objectives

The amendments have the potential to impact the East Stanislaus Region, predominantly through reduced diversions from the Tuolumne River. As the SED and amendments progress forward, the East Stanislaus Region will track the flow objectives and water quality objectives that may be relevant to the region, and will plan response actions needed to adjust regional water use.

Groundwater Quality

Groundwater quality in the Region is variable and has been impacted by overlying land uses in many locations. The Basin Plan identified water quality objectives for groundwater in the San Joaquin River Basin, over which the East Stanislaus Region lies. Objectives for bacteria, chemical constituents, tastes and odors, toxicity, and radioactivity are defined in the Basin Plan for groundwater. Extracted groundwater from both the Modesto and Turlock Subbasins has contained concentrations of multiple constituents in excess of drinking water regulatory requirements, including arsenic, uranium, PCE, TCE, DBCP and nitrate. As a result, many of the Region's groundwater wells have been taken out of service (for example, the City of Modesto has had 21 wells removed from service in recent years due to groundwater quality impacts) and several disadvantaged communities within Stanislaus County have been identified as having small community water systems with known violations of the arsenic and/or nitrate drinking water standards (CDPH, 2013).

High salinity, nitrates, iron, manganese, boron, arsenic, radionuclides, bacteria, pesticides, trichloroethylene and other trace organics have been detected in groundwater in the Turlock Subbasin. In the last 20 years, the City of Turlock has had to discontinue use of five wells due to contamination. Two of the well closures were a result of nitrate contamination, which is a major threat to wells in the City of Turlock. Average nitrate levels have increase from 12 parts per million (ppm) to 21 ppm (as NO_3) over the last 20 years. Arsenic has also been a problem for some wells. Some of the contaminants found in the groundwater occur naturally while others have been introduced by manmade sources, such as from industrial solvents, septic tanks, pesticides and herbicides. The City of Ceres too has had water quality concerns related to specific contaminants in the groundwater. These include many of the same that concern the City of Turlock and Modesto (such as nitrate, uranium, arsenic, and manganese) and nearly all of the City's active wells are impacted by a combination of inorganic contaminants. Wellhead treatment and blending are used to reduce levels of contaminants and in the future, the City of Ceres may replace older wells and/or install new wells and in such a way that the need for wellhead treatment is minimized (West Yost, 2011a).

Groundwater Management Plans (GWMPs) have been prepared for both the Modesto and Turlock Subbasins. The *Integrated Regional Groundwater Management Plan for the Modesto Subbasin* was prepared in 1994 by six agencies forming the Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA). The final draft of the Modesto Subbasin GWMP was completed in June 2005 and was adopted by all member agencies. The *Turlock Groundwater Basin Groundwater Management Plan* was drafted in 2008 by the Turlock Groundwater Basin Association (TGBA). Similarly, this plan was adopted by the member agencies comprising the TGBA. Both GWMPs outlined methods for groundwater monitoring both for groundwater levels and groundwater quality. Local cities and small community water systems conduct water quality monitoring using drinking water supply wells. The data collected are then made available to the public in each municipal water supplier's Consumer Confidence Report (CCR). CDPH regulates the type of monitoring and frequency of data collection to ensure the water meets required standards.

During development of the Turlock Basin GWMP, the TGBA developed Basin Management Objectives, one of which is monitoring groundwater extraction to reduce the potential for land subsidence, indicating how important it is for the TGBA to monitor groundwater quality and levels. Other groundwater monitoring is conducted by other agencies. For example, DWR has a network of wells throughout the valley that are used to monitor groundwater level on an annual or semi-annual basis. Local agencies have a similar program to monitor groundwater levels at local supply wells. The Stanislaus County Department of Environmental Resources (DER) also monitors water quality very closely. There are 61 contamination sites within the Stanislaus County portion of the Turlock Subbasin; the County monitors groundwater quality at these sites quarterly. Most of the water quality data collected from the contaminated sites can be viewed on the SWRCB Geotracker-GAMA website, http://geotracker.waterboards.ca.gov. The TBGA has also participated in the GAMA study, conducted by U.S. Geological Survey (USGS), SWRCB, CDPH, DWR, and Lawrence Livermore Laboratory. The GAMA study has yielded baseline water quality conditions and has allowed for early detection of contamination (TGBA, 2008).

In the Modesto Subbasin, groundwater levels have been measured in about 230 wells by DWR and others. USGS has also partnered with member agencies of the Stanislaus and Tuolumne Rivers GBA to monitor 17 wells in the area for the National Water Quality Assessment Program.

The Stanislaus and Tuolumne Rivers GBA plans to expand the network of monitoring wells in partnership with the USGS. If detections occur in the monitoring wells, the GBA will facilitate meetings between responsible parties and impacted agencies to determine strategies to minimize spread of contaminants. Groundwater monitoring for levels and quality will continue in order to ensure a balanced state of the groundwater basin (Bookman-Edmonston, 2005).

Table 2-16: Monitoring by Member Agencies of Stanislaus and Tuolumne Rivers GBA

Member Agency	Total Number of Wells	No. of Wells Groundwater Levels are Measured	No. of Wells where Samples are Analyzed for Groundwater Quality
Modesto Irrigation District	104	96	104
Oakdale Irrigation District	17	17	
City of Modesto	110[a]		14
Ceres	4		
Walnut Manor	1		
Salida	7		
Del Rio	3		1
Waterford	7		
Hickman	2		1
City of Oakdale	7		
City of Riverbank	7		
Total	**221**	**113**	**135**

Source: Bookman-Edmonston, 2005. Table 5-1.

a. Total number of wells provided by City of Modesto staff.

Chapter 3 Climate Change

3.1 Introduction

There is mounting scientific evidence that global climate conditions are changing and will continue to change as a result of the continued build-up of greenhouse gases (GHGs) in the Earth's atmosphere and other issues. Changes in climate can affect municipal water supplies through modifications in the timing, amount, and form of precipitation, as well as water demands and the quality of surface runoff. These changes can affect all elements of water supply systems, from watersheds to reservoirs, conveyance systems, and treatment plants.

Planning for and adapting to anticipated changes in climate will be essential to ensuring water supply reliability for all users and to protecting sensitive infrastructure against potentially more frequent and extreme precipitation and wildfire events. This chapter summarizes possible climate change impacts on the State of California and the East Stanislaus Integrated Regional Water Management (IRWM) region, evaluates the potential impacts of those changes with regard to water resource management, assesses the vulnerability of the region to anticipated climate change impacts, and provides recommended adaptation and mitigation strategies to address uncertainty and reduce GHG emissions. In addition, a plan for ongoing data collection to fill data gaps and monitor the frequency and magnitude of local hydrologic and atmospheric changes is provided.

3.2 Statewide Observation and Projections

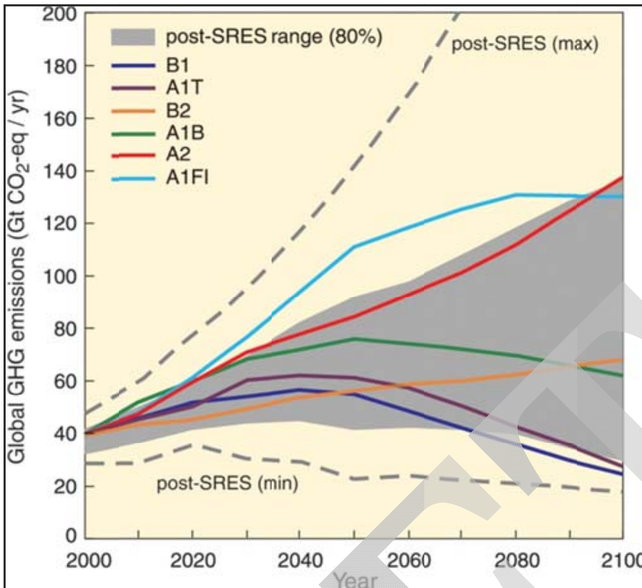
Indications of climate change have been observed over the last several decades throughout California and are apparent in long-term historic analysis. Statewide average temperatures have increased by about 1.7°F from 1895 to 2011, with the greatest warming in the Sierra Nevada (Moser et al., 2012). Although the State's weather has followed the expected pattern of a largely Mediterranean climate throughout the past century, no consistent trend in the overall amount of precipitation has been detected, except that a larger proportion of total precipitation is falling as rain instead of snow (Moser et al., 2012).

Multiple models have been developed and run to evaluate global and regional climate change impacts. Global Climate Models (GCMs) have been used to simulate a range of potential future GHG emission scenarios, reflecting possible population increases and human behavioral patterns. The Intergovernmental Panel on Climate Change (IPCC) has established the A2 and B1 scenarios, which represent a middle range of possible emissions. The A2 scenario is characterized by an increasing population, regionally-oriented economic development and independently operating, self-reliant nations. In the A2 scenario, economic growth is uneven, leading to a growing income gap between developed and developing parts of the world.

The B1 scenario assumes a more integrated and ecologically friendly future, and reflects a high level of environmental and social consciousness combined with global cooperation for sustainable development. This scenario is characterized by rapid economic growth and movement toward a service and information economy. It also assumes reductions in materials intensity and the introduction of clean and resource-efficient technologies combined with an emphasis on global solutions to economic, social and environmental stability.

Since the IPCC released these scenarios in 2000, the world has followed a "business as usual" emissions pathway (Figure 3-1). This most closely resembles the A2 scenario, although temperature changes over the next 30 to 40 years will be largely determined by past emissions.

Figure 3-1: IPCC Climate Change Scenarios



Source: IPCC 2007

3.2.1 Temperature and Precipitation Changes

While California's average temperature has increased by 1°F in the last one hundred years, trends are not uniform across the state. The Central Valley has actually experienced a slight cooling trend in the summer, likely due to an increase in irrigation (CEC, 2008). Higher elevations have experienced the highest temperature increases (DWR, 2008). Many of the state's rivers have seen increases in peak flows in the last 50 years (DWR, 2008).

GCMs project that in the first 30 years of the 21st century, overall summertime temperatures in California will increase by 0.9 to 3.6°F (CAT, 2009) and average temperatures will increase by 3.6 to 10.8°F by the end of this century (Cayan et al., 2006). Increases in temperature are not likely to be felt uniformly across California. Models generally project that warming will be greater in California in the summer than in the winter (CAT, 2009) and inland areas will experience more extreme warming than coastal areas (CNRA, 2009). These non-uniform warming trends are among the reasons that regional approaches to addressing climate change are important.

While historical trends in precipitation do not show a statistically significant change in average precipitation over the last century (DWR, 2006), regional precipitation data show a trend of increasing annual precipitation in Northern California (DWR, 2006) and decreasing annual precipitation throughout Southern California over the last 30 years (DWR, 2008). A key change in precipitation patterns has been more winter precipitation falling as rain instead of snow (CNRA, 2012), leading to increased streamflow in the winter and decreased streamflow in the spring and summer, when water demands are the greatest. This increased streamflow variability could lead to increased risks of flooding, levee failure, saline water intrusion and flood- or drought-induced habitat destruction.

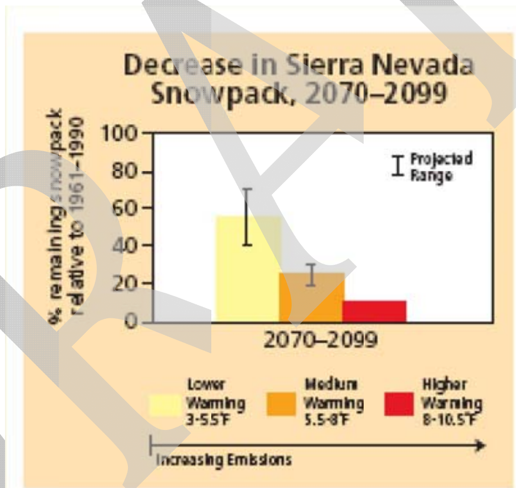
While temperature projections exhibit high levels of agreement across various models and emissions scenarios, projected changes in precipitation are uncertain, and therefore more varied. Taken together, downscaled GCM results show little, if any, change in average precipitation for California before 2050 (DWR, 2006), with a drying trend emerging after 2050 (BOR, 2011; CCSP, 2009). While little change in precipitation is projected by the GCMs as a group, individual GCM results are considerably varied. The models inaccuracies leave uncertainty in the future projections regarding precipitation trends. Climate projections therefore imply an increase in the uncertainty of future precipitation conditions.

3.2.2 Sea-level Rise, Snowpack Reduction, and Extreme Events

In the last century, the California coast has seen a sea level rise of seven inches (DWR, 2008). The average April 1st snowpack in the Sierra Nevada region has decreased in the last half century (Howat and Tulaczyk, 2005; CCSP, 2008), and wildfires are becoming more frequent, longer, and more widespread (CCSP, 2008).

As the climate warms, the Sierra Nevada's snowpack (a primary storage mechanism for California's water supply) is anticipated to continue to shrink. Based on simulations conducted to date, Sierra Nevada snowpack is projected to shrink by 30% between 2070 and 2099, with drier, higher warming scenarios putting that number as high as 80% (Kahrl and Roland-Holst, 2008). Additionally, extreme events are expected to become more frequent, including wildfires, floods, droughts, and heat waves. In contrast, freezing spells are expected to decrease in frequency over most of California (CNRA, 2009). While GCM projections may indicate little, if any, change in average precipitation moving into the future, extreme precipitation events are expected to become more commonplace (CBO, 2009). The combination of drier and warmer weather compounds expected impacts on water supplies and ecosystems in the Southwestern United States (CCSP, 2009) with wildfires expected to continue to increase in both frequency and severity (CCSP, 2009).

Figure 3-2: Projected Snowpack Changes in the Sierra Nevada



Source: Hopmans et al. 2008

3.3 Legislative and Policy Context

In order to address currently-predicted climate change impacts to California's water resources, the California Department of Water Resources' (DWR's) IRWM Grant Program Guidelines require that IRWM Plans describe, consider and address the effects of climate change on their region, and consider reducing GHG emissions when developing and implementing projects. Part of this process involves framing the IRWM analysis and response actions in the context of State legislation and policies that have been formed to address climate change. The following summarizes the legislation and policies that were considered as part of this IRWM Plan.

Executive Order (EO) S-3-05 (2005)

EO S-3-05, signed on June 1, 2005 by Governor Arnold Schwarzenegger, is a key piece of legislation that has laid the foundation for California's climate change policy. This legislation recognized California's vulnerabilities to the impacts of climate change, including vulnerabilities of water resources. EO S-3-05 established three GHG reduction targets for California:

- By 2010, reduce GHG emissions to 2000 California levels
- By 2020, reduce GHG emissions to 1990 California levels
- By 2050, reduce GHG emissions to 80 percent below 1990 California levels

In addition to establishing GHG reduction targets for California, EO S-3-05 required the head Secretary of the California Environmental Protection Agency (CalEPA) to establish the Climate Action Team (CAT) for State agencies to coordinate oversight of efforts to meet these targets. As laid out in the EO, the CAT submits biannual reports to the governor and State legislature describing progress made toward reaching the targets.

There are currently 12 sub-groups within CAT, one of which is the Water-Energy group (also known as WET-CAT). WET-CAT was tasked with coordinating the study of GHG effects on California's water supply system, including the development of GHG mitigation strategies for energy consumption related to water use. Since the adoption of the Assembly Bill 32 Scoping Plan (see the following section), WET-CAT has been working on the implementation and analyses of six water-related measures identified in the Scoping Plan:

1. Water Use Efficiency
2. Water Recycling
3. Water System Energy Efficiency
4. Reuse Urban Runoff
5. Increase Renewable Energy Production
6. Public Goods Charge for Water

Assembly Bill 32: The California Global Warming Solutions Act of 2006 (2006)

Assembly Bill 32 (AB 32), the California Global Warming Solutions Act of 2006, laid the foundation for California's response to climate change. In 2006, AB 32 was signed by Governor Schwarzenegger to codify the mid-term GHG reduction target established in EO S-3-05 (reduce GHG emissions to 1990 levels by 2020). AB 32 directed the California Air Resources Board (CARB) to develop discrete early actions to reduce GHG emissions by 2007, and to adopt regulations to implement early action measures by January 1, 2010.

Climate Change Scoping Plan (2008)

AB 32 required CARB to prepare a Scoping Plan to identify and achieve reductions in GHG emissions in California. The Climate Change Scoping Plan, adopted by CARB in December 2008, recommends specific strategies for different business sectors, including water management, to achieve the 2020 GHG emissions limit.

Senate Bill 97 (2007)

Senate Bill 97 (SB 97) recognized the need to analyze greenhouse gas emissions as part of the California Environmental Quality Act (CEQA) process. SB 97 directed the Governor's Office of Planning and Research (OPR) to develop, and the Natural Resources Agency to adopt, amendments to the CEQA Guidelines to address the analysis and mitigation of greenhouse gas emissions. On December 31, 2009, the Natural Resources Agency adopted amendments to the CEQA Guidelines and sent them to the California Office of Administrative Law for approval and filing with the Secretary of State (http://www.ceres.ca.gov /ceqa/guidelines/). The CEQA Guidelines are not prescriptive; rather they encourage lead agencies to consider many factors in performing a CEQA analysis, and maintain discretion with lead agencies to make their own determinations based on substantial evidence.

Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water (2008)

DWR, in collaboration with the State Water Resources Control Board (SWRCB), other state agencies, and numerous stakeholders, has initiated a number of projects to begin climate change adaptation planning for the water sector. In October 2008, DWR released the first state-level climate change adaptation strategy for water resources in the United States, and the first adaptation strategy for any sector in California. Entitled *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*, the report details how climate change is currently affecting the state's water supplies, and sets forth ten adaptation strategies to help avoid or reduce climate change impacts to water resources. Central to these adaptation efforts will be the full implementation of IRWM plans, which address regionally-appropriate management practices that incorporate climate change adaptation. These plans will evaluate and provide a comprehensive, economical, and sustainable water use strategy at the watershed level for California.

Executive Order S-13-08 (2008)

Given the potentially serious threat of sea level rise to California's water supply and coastal resources, and the subsequent impact it would have on our state's economy, population, and natural resources, Governor Schwarzenegger issued EO S-13-08 to enhance the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation, and extreme weather events. This order required the preparation of the first California Sea Level Rise Assessment Report (by the National Academy of Sciences) to inform the State as to how California should plan for future sea level rise; required all state agencies to consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess potential vulnerabilities of proposed projects and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise; and required the Climate Action Team to develop state strategies for climate adaptation, water adaptation, ocean and coastal resources adaptation, infrastructure adaptation, biodiversity adaptation, working landscapes adaptation, and public health adaptation.

California Climate Adaptation Strategy (2009)

In response to the passage of EO S-13-08, the Natural Resource Agency wrote the report entitled *2009 California Climate Adaptation Strategy* (CAS) to summarize the best known science on climate change impacts in the state, to assess vulnerability, and to outline possible solutions that can be implemented within and across the state agencies to promote climate change resilience. The document outlined a set of guiding principles that were used in developing the strategy, and resulted in the preparation of 12 key recommendations as follows:

1. Appoint a Climate Adaptation Advisory Panel (CAAP) to assess the greatest risks to California from climate change and to recommend strategies to reduce those risks, building on the Climate Change Adaptation Strategy.
2. Implement the 20x2020 water use reductions and expand surface and groundwater storage; implement efforts to fix Delta water supply, quality and ecosystems; support agricultural water use efficiency; improve statewide water quality; improve Delta ecosystem conditions; and stabilize water supplies as developed in the Bay Delta Conservation Plan.
3. Consider project alternatives that avoid significant new development in areas that cannot be adequately protected from flooding, wildfire, and erosion due to climate change.
4. Prepare, as appropriate, agency-specific adaptation plans, guidance or criteria.
5. For all significant state projects, including infrastructure projects, consider the potential impacts of locating such projects in areas susceptible to hazards resulting from climate change.

6. The CAAP and other agencies will assess California's vulnerability to climate change, identify impacts to state assets, and promote climate adaptation/mitigation awareness through the Hazard Mitigation Web Portal and My Hazards Website, as well as other appropriate sites.
7. Identify key California land and aquatic habitats that could change significantly during this century due to climate change.
8. The California Department of Public Health will develop guidance for use by local health departments and other agencies to assess mitigation and adaptation strategies, which include impacts on vulnerable populations and communities, and assessment of cumulative health impacts.
9. Communities with General Plans and Local Coastal Plans should begin, when possible, to amend their plans to assess climate change impacts, identify areas most vulnerable to these impacts, and develop reasonable and rational risk reduction strategies using the CAS as guidance.
10. State firefighting agencies should begin immediately to include climate change impact information into fire program planning to inform future planning efforts.
11. State agencies should meet projected population growth and increased energy demand with greater energy conservation and an increased use of renewable energy.
12. New climate change impact research should be broadened and funded.

GHG Reporting Rule (2009)

While California has taken the lead in climate change policy and legislation, there have been several recent developments at the federal level affecting climate change legislation. On September 22, 2009, USEPA released the Mandatory Reporting of Greenhouse Gases Rule (74FR56260, Reporting Rule), which requires reporting of GHG data and other relevant information from large sources and suppliers in the United States. Starting in 2010, facility owners that emit 25,000 metric tons of GHGs or more per year are required to submit to the USEPA an annual GHG emissions report with detailed calculations of facility GHG emissions. These activities will dovetail with the AB 32 reporting requirements in California.

Senate Bill 375 (2008)

The Sustainable Communities and Climate Protection Act of 2008 (Senate Bill [SB] 375) was passed to enhance the State's ability to reach its AB 32 goals by promoting good planning with a goal of more sustainable communities. SB 375 required the CARB to develop regional GHG emission reduction targets for passenger vehicles and 2020 and 2035 GHG emission targets for each region covered by one of the State's 18 California's metropolitan planning organizations (MPOs). Each of the MPOs then prepares a sustainable communities strategy that demonstrates how the region will meet its GHG reduction target through integrated land use, housing and transportation planning. Once adopted, these sustainable communities strategies are incorporated into the region's federally enforceable regional transportation plan.

California Water Plan Update (2009)

The ***California Water Plan*** (CWP) provides a collaborative planning framework for elected officials, agencies, tribes, water and resource managers, businesses, academia, stakeholders, and the public to develop findings and recommendations and make informed decisions for California's water future. The plan, updated every five years, presents the status and trends of California's water-dependent natural resources, water supplies, and agricultural, urban, and environmental water demands for a range of plausible future scenarios and evaluates different combinations of regional and statewide resource management strategies to reduce water demand, increase water supply, reduce flood risk, improve water quality, and enhance environmental and resource stewardship. Last updated in 2009, the CWP Update provided statewide water balances for eight water years (1998 through 2005), demonstrating the state's water demand and supply variability. The updated plan built on the framework and resource management strategies outlined in the CWP Update 2005 promoting IRWM and improved statewide water and flood management systems. The CWP Update 2009 provided the following 13 objectives to help achieve the CWP goals:

1. Expand integrated regional water management
2. Use and reuse water more efficiently
3. Expand conjunctive management of multiple supplies
4. Protect surface water and groundwater quality
5. Expand environmental stewardship
6. Practice integrated flood management
7. Manage a sustainable California Delta
8. Prepare Prevention, Response and Recovery Plans
9. Reduce energy consumption of water systems and uses
10. Improve data and analysis for decision-making
11. Invest in new water technology
12. Improve tribal water and natural resources
13. Ensure equitable distribution of benefits

The plan projects an uncertain future with respect to population, land use, irrigated crop area, environmental water and background water conservation, water demands, and climate variability. The CWP Update 2009 presents 27 resource management strategies to provide a range of choices and building blocks in addressing future uncertainty. Finally, the CWP Update 2009 provided regional reports that summarized water conditions, provided a water balance summary, described regional water quality, and described water/flood planning and management on a hydrologic region basis. The regional summaries then provided a summary of challenges facing each of the hydrologic regions and provided future scenarios for the region.

Climate Ready Utilities (2010)

In the fall of 2009, the USEPA convened a Climate Ready Water Utilities (CRWU) Working Group under the National Drinking Water Advisory Council (NDWAC). This working group prepared a report that documented 11 findings and 12 recommendations relating to the development of a program enabling water and wastewater utilities to prepare long-range plans that account for climate change impacts. The report, delivered to USEPA in 2010, also included an adaptive response framework to guide climate readiness activities, and the identification of needed resources and possible incentives to support and encourage utility climate readiness. This report resulted in the preparation of the USEPA's Climate Ready Water Utilities Program and the development of tools and resources to support water and wastewater utilities in their planning. These tools and resources include:

- Climate Resilience Evaluation and Awareness Tool (CREAT) – a software tool to assist utility owners and operators in understanding potential climate change impacts and in assessing the related risks to their utilities.
- Climate Ready Water Utilities Toolbox – a searchable toolbox that contains resources that support all states of the decision process, from basic climate science through integration of mitigation and adaptation into long-term planning.
- Adaptation Strategies Guide – an interactive guide to assist utilities in gaining a better understanding of what climate-related impacts they may face in their region and what adaptation strategies can be used to prepare their system for those impacts.
- Climate Ready Water Utilities and Climate Ready Estuaries – USEPA initiative working to coordinate their efforts and support climate change risk assessment and adaptation planning.

National Water Program 2012 Strategy: Response to Climate Change (2012)

The USEPA has prepared and released its Draft *National Water Program 2012 Strategy: Response to Climate Change* to address climate change impacts on water resources and the USEPA's water programs. The report identifies core programmatic elements of the strategy in the form of programmatic visions, goals and strategic actions, with each long-term vision (or outcome) documented with an identified set of goals that reflect the same long-term timeframe as the vision and several strategic actions to be implemented in the next three to eight years to pursue the longer-term goals and visions. The draft report also includes ten guiding principles for implementing the strategy outlined in the vision, goals and strategic actions and recommendations for cross-cutting program support.

3.4 Regional Climate Change Projections and Impacts

The East Stanislaus IRWM region lies within the San Joaquin River Hydrologic Region and contains the Stanislaus, Tuolumne, Merced and San Joaquin Rivers and Dry Creek. The Stanislaus, Tuolumne and Merced Rivers are all tributaries to the San Joaquin River with the Tuolumne having the largest watershed in the San Joaquin River system (Epke, et al., 2010). Modesto Irrigation District and Turlock Irrigation District operate one hydroelectric facility (the Don Pedro Hydroelectric Project) with an online capacity of 203 MW on the Tuolumne River. The New Don Pedro Reservoir has a capacity of 2.03 million AF. Merced Irrigation District operates three hydroelectric facilities in the region with an online capacity of 108 MW, as well as two dams (New Exchequer Dam and McSwain Dam) with a total water storage capacity of over 1 million AF. There is hydroelectric generation on the North Fork of the Stanislaus River, however this facility is operated by Calaveras County Water District and is outside the East Stanislaus Region. New Melones Reservoir is the major water supply reservoir on the Stanislaus River with a capacity of 2.4 million AF.

3.4.1 Recent Regional Studies and Research

At present, all major tributaries to the San Joaquin River are being studied with respects to anticipated impacts from climate change. Studies currently underway include:

- Changes in snow cover patterns in the Sierra Nevada (University of Washington);
- The role of atmospheric rivers in extreme events in the Sierra Nevada (USGS);
- Impacts of climate changes on soil properties and habitats in the Sierra Nevada (UC-Merced and USGS); and
- Study of the effects of climate change on hydrology and stream temperatures in the Merced and Tuolumne River watersheds (Santa Clara University).

In general, these studies are multi-year endeavors and are either in progress or have yielded data that are currently being evaluated. While preliminary study reports appear to support other climate change impact observations and modeling simulations, the final published conclusions of these studies are, for the most part, not currently available.

3.4.3 Climate Change Impacts on Surface Water

East Stanislaus Region Relation to Local Rivers

The East Stanislaus Region is bound on the north by the Stanislaus River and on the south by the Merced River. Dissecting the region are Dry Creek and the Tuolumne River, and toward the western edge of the regional boundary is the San Joaquin River.

Multiple cities and agencies/districts rely on surface water as part of their overall supply portfolio. The City of Modesto relies on Tuolumne River surface water purchased wholesale from Modesto Irrigation District (MID), and the proposed expanded MRWTP and Regional Surface Water Supply Project (RSWSP) will expand this reliance for the cities of Modesto, Turlock, and Ceres. MID and Turlock Irrigation District (TID) rely predominantly on their Tuolumne River water rights to provide irrigation to their customers as well as (currently for MID) potable water for retail providers. Oakdale Irrigation District depends predominantly on their surface water rights on the Stanislaus River, while Merced Irrigation District similarly relies on water from the Merced River. And just as importantly, all these rivers flow to the San Joaquin River and to the Sacramento-San Joaquin Delta, a resource that much of California relies on.

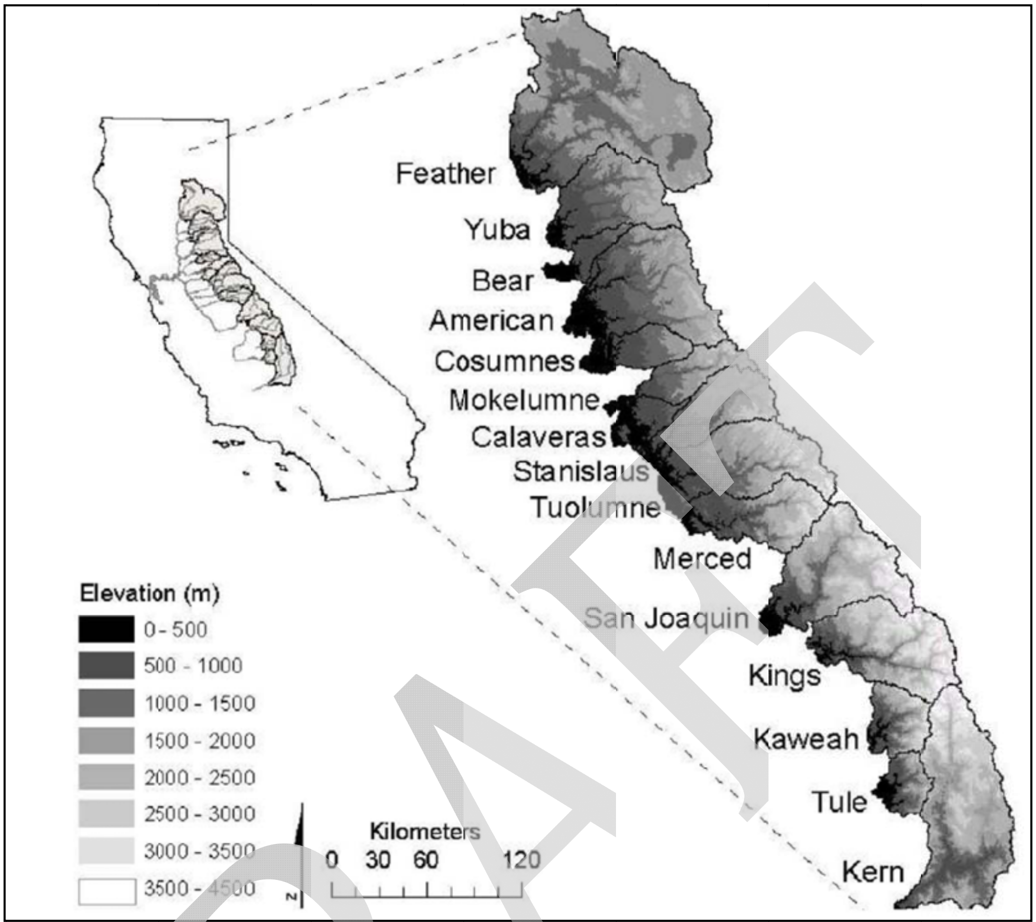
Potential Effects of Climate Change on the Rivers

A study was completed in mid-2010 to evaluate the potential impact of climate change on California's major rivers. As described in *Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada* (Null, et. al., 2010), the differential hydrologic responses of 15 west-slope Sierra Nevada watersheds in California to climate change were evaluated. The Stanislaus, Tuolumne, and Merced River Watersheds were three of the watersheds included in this analysis; Figure 3-3 shows the watersheds evaluated in the 2010 study.

The Sierra Nevada mountain range is a water source for much of California, including the East Stanislaus Region. Snowmelt from the mountains feed the Stanislaus and Merced Rivers, as well as the Tuolumne River, one of the primary water supply sources for the region. The Water Evaluation and Planning System (WEAP21) model, developed by the non-profit Stockholm Environmental Institute, was used by the University of California, Davis, Center for Watershed Sciences to develop an unimpaired hydrologic model of the Sierra Nevada to explicitly simulate intra-basin hydrologic dynamics to better understand localized sensitivity to climate warming. The model is a climate-forced rainfall-runoff model that covers the area from the crest of the Sierra Nevada to the floor of the Central Valley. Incremental climate warming alternatives were developed with uniform increases in air temperature of 2°C, 4°C, and 6°C to evaluate impacts on regional water systems. During these evaluations, only air temperatures were increased while other variables remain the same. Due to uncertainty regarding the change of precipitation in the future due to climate change, historic hydrology was used with a modeled period of 1981 to 2001. The modeled period covers a wide range of climatic variability including the wettest year on record, the flood year of record and a prolonged drought, 1983, 1997, and 1988-1992, respectively.

The WEAP21 model was used to determine changes in mean annual flow (MAF), centroid timing (CT) and low-flow duration (LFD) for each of the studied watershed. The results concluded, in general, that the anticipated hydrologic changes from climate change to the watersheds on the western edge of the Sierra Nevada mountains are not uniform and therefore risks to water resources are not uniform and are watershed-specific.

Figure 3-3: West-slope Sierra Nevada Watersheds



Source: Null et al, 2010.

The Sierra Nevada generally has a cool, wet season from November to April and a warm, dry season from May to October. The dry season has infrequent precipitation, except for high elevation thunderstorms, while the wet season is characterized as having precipitation fall as snow and rain, with the snowline at approximately 3,200 feet. During the wet season, precipitation averages 43 inches a year, but it can be highly dependent on elevation, latitude and local weather conditions. The average rainfall in the three watersheds within the East Stanislaus Region (Stanislaus, Tuolumne and Merced River watersheds), in addition to other physical characteristics of each watershed, is presented in Table 3-1. Water resource benefits (i.e. hydroelectric generation) for the watersheds are shown in Table 3-2.

Table 3-1: Physical Characteristics of Watersheds within Region

Watershed	Area (acres)	Mean Precipitation (inches/year)	Precipitation Range (in/year)	Elevation Range (ft.)
Stanislaus	578,227	45.6	25.5 – 66.2	692 – 11,546
Tuolumne	980,837	43.3	17.1 – 68.0	803 – 13,084
Merced	663,195	41.1	19.7 – 62.7	803 – 13,087

Source: Null et al, 2010. Table 1.

Table 3-2: Watersheds' Water Resource Benefits

Watershed	Hydropower Facilities	FERC Relicenses (next 40 years)	Total Water Storage Capacity (TAF)	No. of Dams (> 1TAF)	Wild and Scenic Rivers
Stanislaus	12	7	2,842	12	-
Tuolumne	6	1	2,717	9	134
Merced	3	2	1,042	2	197

Source: Null et al, 2010. Table 2.

Mean Annual Flow was the first parameter modeled using the WEAP21 model. MAF from the Sierra Nevada is vital to future water supply for the region, as well as to hydropower generation and aquatic ecosystems. Due to the increases in temperature and evapotranspiration associated with climate change, the overall trend in the watersheds modeled is a reduction of MAF as a result of increased air temperatures. Results of the modeling of the 15 watersheds indicated that for 2°C, 4°C, and 6°C temperature increases, MAF would be reduce by an average 3%, 6%, and 9%, respectively. A summary of the reduction in average annual flow for the three watersheds within the East Stanislaus Region due to the varied temperature increases modeled are presented in Table 3-3. Overall, watersheds in the northern portion of the Sierra Nevada had greater reductions in MAF than other regions of the Sierra Nevada. Reductions in MAF will impact water supplies for downstream urban, agricultural and environmental water uses.

Table 3-3: MAF by Climate Alternative and Watershed

Watershed	Annual Average Flow (TAF)				% Reduction from Baseline		
	Baseline	2°C	4°C	6°C	2°C	4°C	6°C
Stanislaus	1,266	1,235	1,201	1,163	2.4%	5.1%	8.1%
Tuolumne	1,982	1,946	1,908	1,868	1.8%	3.7%	5.8%
Merced	1,093	1,031	1,031	1,003	3.0%	5.6%	8.2%

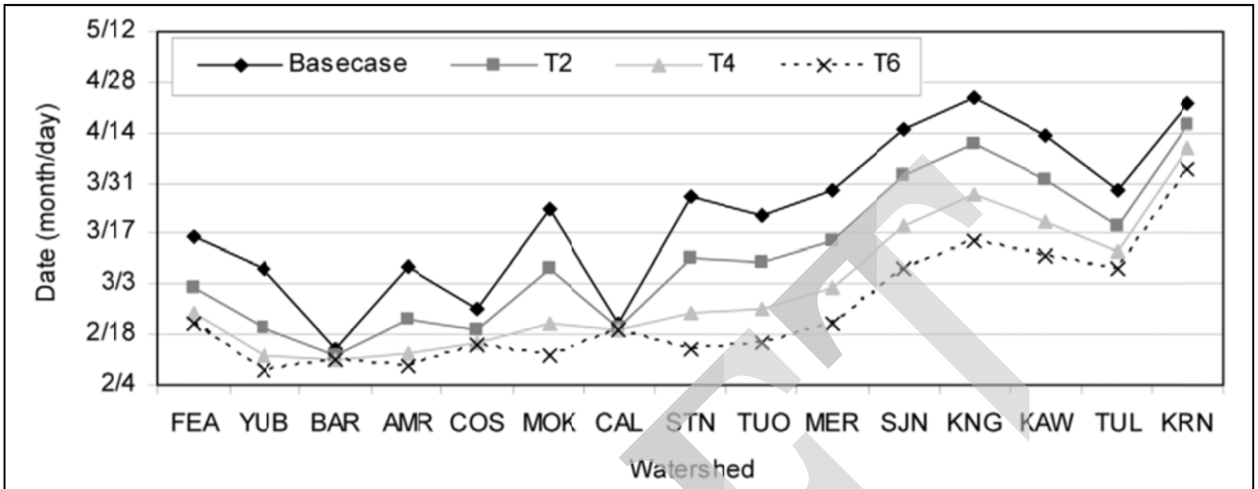
Source: Null et al, 2010. Table 5.
TAF – Thousand Acre-Feet

Runoff centroid timing (CT), the date at which the total annual runoff at the outlet of each watershed has passed, was also simulated for the 15 studied watersheds using the WEAP21. CT is mostly driven by snowmelt such that watersheds with lower elevations that do not reach the crest of the Sierra Nevada (e.g. Bear, Cosumnes, Calaveras Rivers) experience small changes in runoff CT as they receive less precipitation in the form of snow fall and therefore have less snowmelt. The watersheds with very high elevations (e.g. Kern River) maintain cooler air temperatures later in the year, so although there would be reduced snowfall as a result of climate warming (due to increased temperatures), the snowmelt continued late into the spring resulting in a minimal change to runoff CT.

The Stanislaus River had the greatest change in CT from the baseline conditions of all watersheds in the ES IRWM Region. Under baseline conditions, CT was estimated to occur on March 27th, but under 2°C, 4°C, and 6°C temperature increases, timing was estimated to occur March 10th, February 24th, and February 14th, respectively (see Figure 3-4). The San Joaquin, Mokelumne, Kings, and Merced Rivers also had shifts in timing of about five to six weeks earlier in the year with a 6°C temperature increase. In general, for every 2°C increase in temperature, average CT occurred nearly

2 weeks earlier. The average timing for the Tuolumne River was about the same as the Stanislaus River. In summary, the Stanislaus, Tuolumne and Merced watersheds may have significant changes in snowmelt and CT.

Figure 3-4: Average Centroid Timing by Watershed and Climate Scenario (north to south)



Source: Null et al, 2010 – Figure 6, page 8
Base case – baseline scenario
T2 – 2°C temperature increase
T4 – 4°C temperature increase
T6 – 6°C temperature increase

FEA – Feather
YUB – Yuba
BAR – Bear
AMR – American
COS – Cosumnes

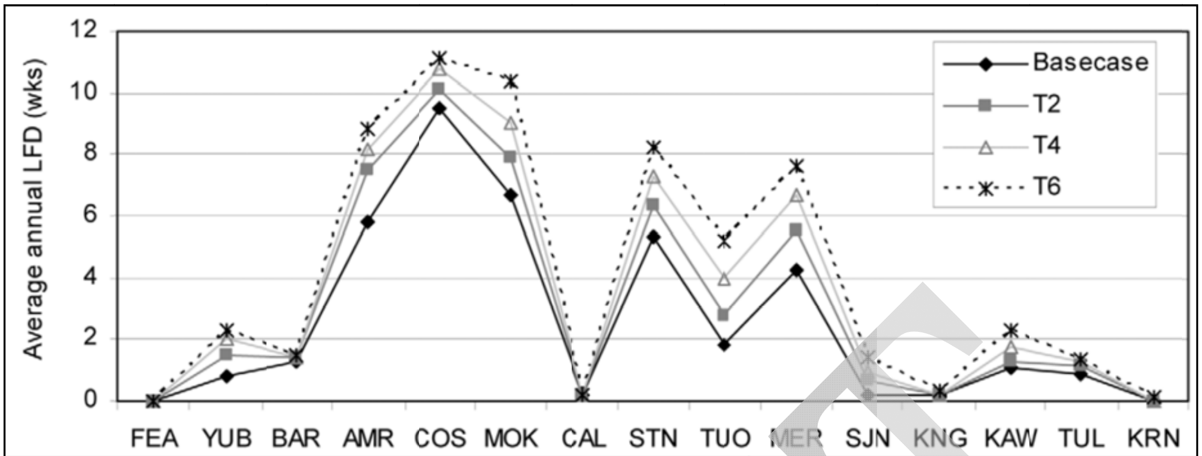
MOK – Mokelumne
CAL – Calaveras
STN – Stanislaus
TUO – Tuolumne
MER – Merced

SJN – San Joaquin
KNG – Kings
KAW – Kaweah
TUL – Tule
KRN – Kern

The final parameter modeled for watersheds in the study using the WEAP21 was low flow duration (LFD), or the number of weeks with low flow conditions. Low flow weeks are when weekly discharge divided by total discharge for the water year is less than 1% of the total discharge for that water year. Also, in order to qualify as LFD, there has to be at least three consecutive low flow weeks.

The Mokelumne, Tuolumne, American and Stanislaus River watersheds had the most significant changes in average LFDs from baseline conditions with each experiencing approximately one more week of LFD for each 2°C increase in temperature. The changes in average annual LFD for each watershed for the three temperature increases modeled are shown in Figure 3-5.

Figure 3-5: Average Annual LFD by Watershed and Climate Scenario (north to south)

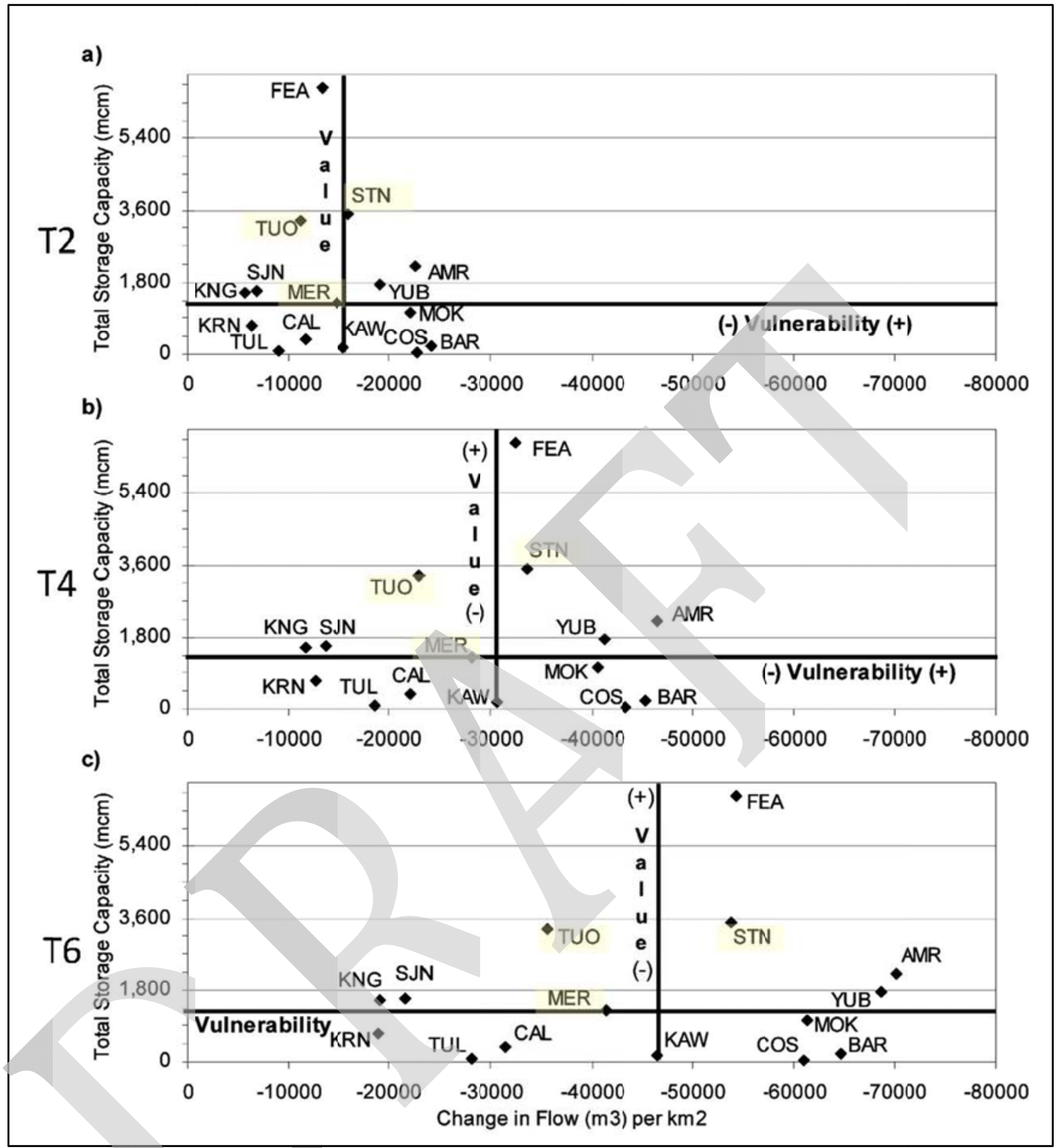


Source: Null et al, 2010 – Figure 6, page 8
Base case – baseline scenario
T2 – 2°C temperature increase
T4 – 4°C temperature increase
T6 – 6°C temperature increase

A number of comparisons were made in order to measure the intrinsic vulnerability of the 15 watersheds, which was defined in the study as the "… inherent ability of the system to cope with external, natural, and anthropogenic impacts that affect its state and character in space and time." Unimpaired change in MAF (per square kilometer) to total water storage, unimpaired change in CT to total hydropower capacity, and unimpaired change in LFD to mountain meadow area were the comparisons made for each watershed under the 2°C, 4°C, and 6°C climate warming scenarios, the results of which are presented in Figure 3-6, Figure 3-7, and Figure 3-8, respectively.

The watersheds on the right side of the graphs shown in Figure 3-6 had the greatest reduction in MAF, so were determined to be most vulnerable to climate warming. Value and vulnerability axes were placed on the median values for all of the watersheds so that half of the remaining watersheds had more water storage capacity and reduction in MAF. The watersheds that are in the top right quadrant are those that are valuable for water storage and most vulnerable to climate warming. As shown the figure below, the Stanislaus watershed is one of three watersheds in the upper right quadrant (and therefore considered vulnerable to climate changes) since it has 2,282 thousand acre-feet (TAF) of total water storage and the model exhibited a significant reduction in MAF, which could likely affect irrigation and urban water storage as well as aquatic and riparian ecosystems.

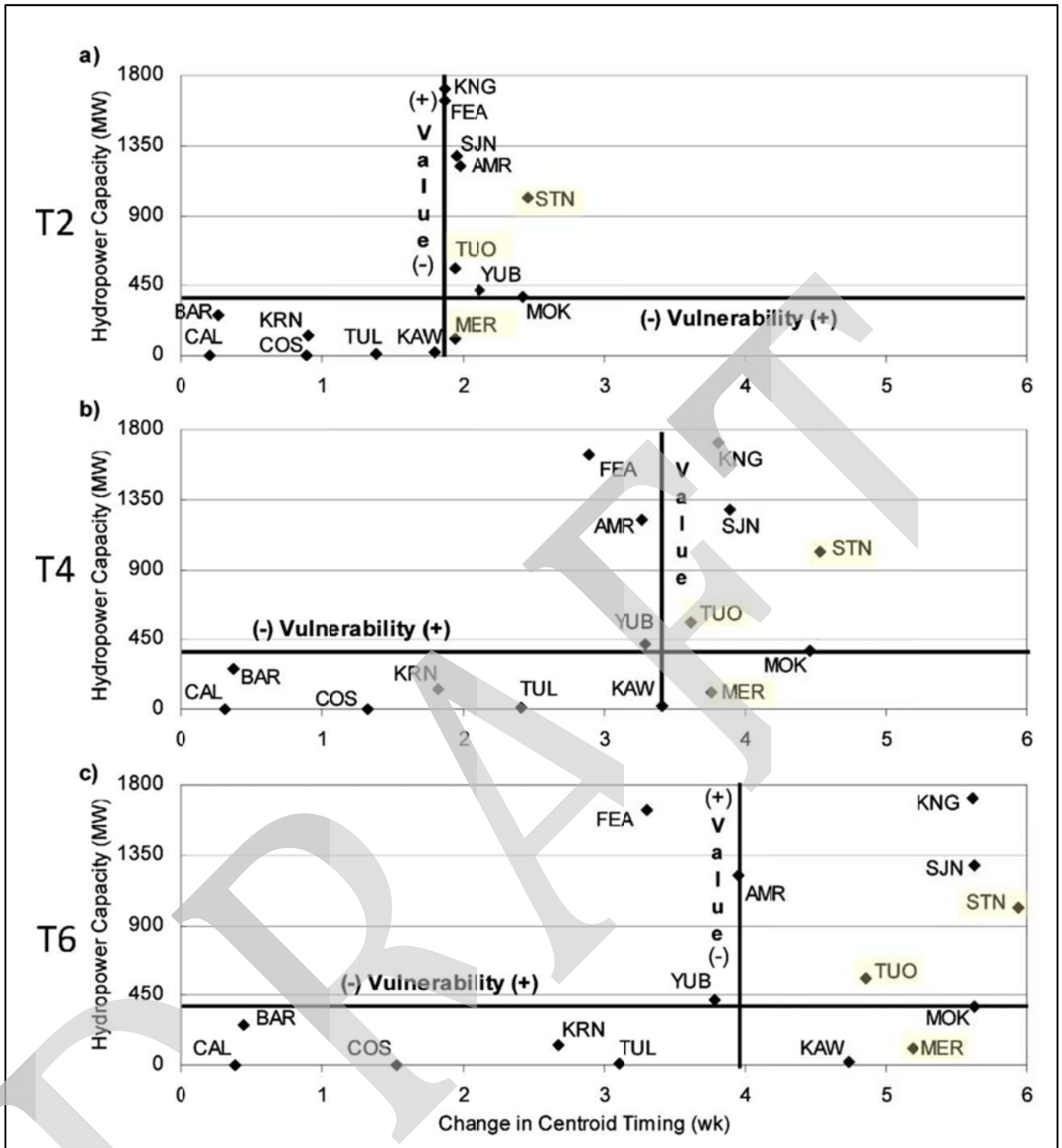
Figure 3-6: Relative Vulnerability Based on Total Water Storage and Change in MAF



Source: Null et al, 2010 – Figure 11, page 12
T2 – 2°C temperature increase
T4 – 4°C temperature increase
T6 – 6°C temperature increase

Changes to runoff CT were compared with hydropower capacity for each watershed, as shown in Figure 3-7. Watersheds that have a high hydropower capacity and may experience substantial changes in runoff timing with climate warming represent the more valuable and vulnerable watersheds. Therefore, similar to the MAF analysis, watersheds in the upper right quadrants of Figure 3-7 are those that are valuable for hydropower generation and have been found to be vulnerable to runoff timing changes associated with climate change. As seen below, the Tuolumne and Stanislaus watersheds both generate a substantial amount of hydropower and simulations for these watersheds both exhibited significant changes in CT.

Figure 3-7: Relative Vulnerability Based on Total Available Hydropower and Change in CT

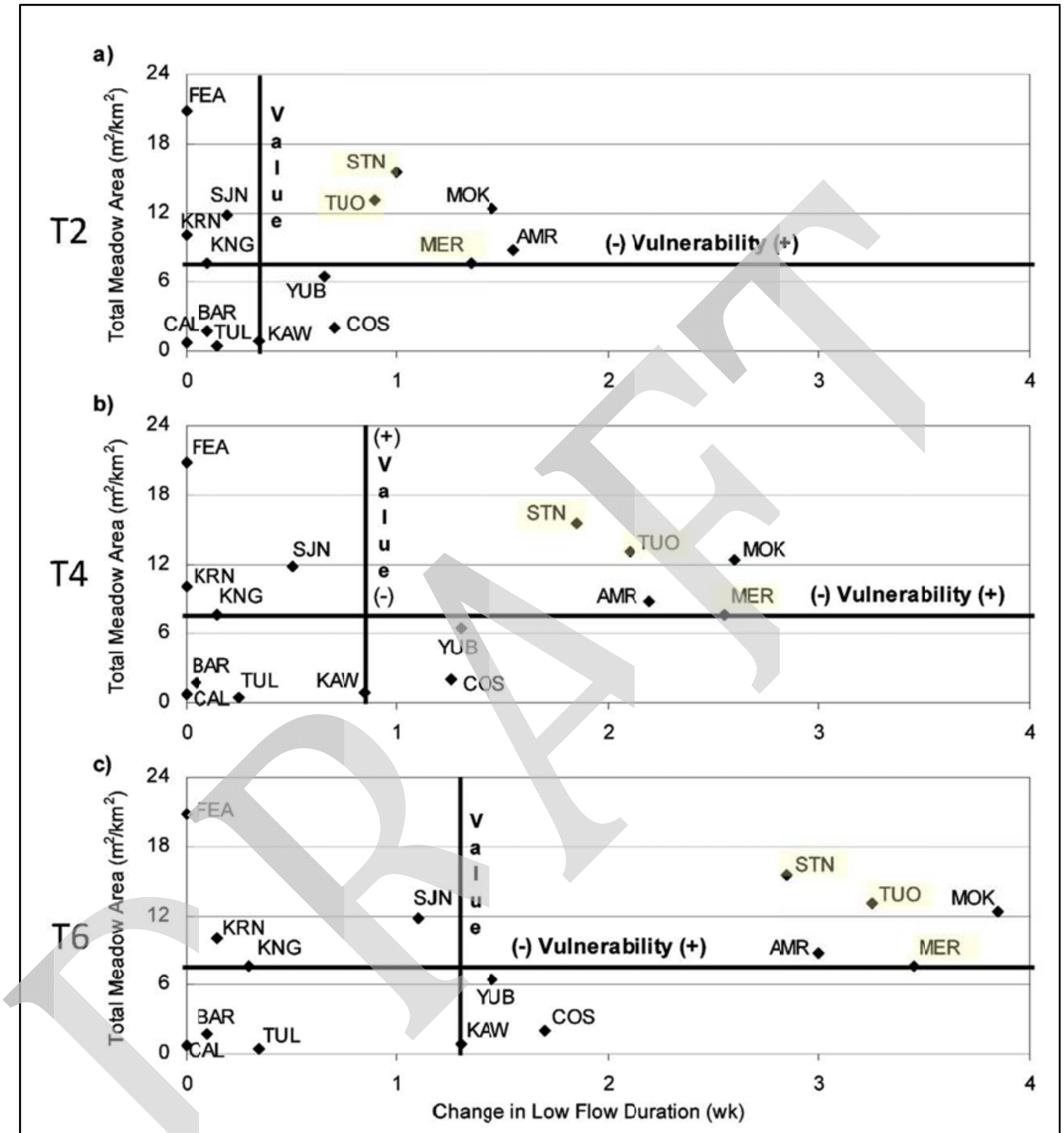


Source: Null et al, 2010 – Figure 12, page 13
T2 – 2°C temperature increase
T4 – 4°C temperature increase
T6 – 6°C temperature increase

LFD was compared to mountain meadow area, used as a representative for montane ecosystems, to evaluate the potential ecological impacts that may result from climate change. Meadows provide environmental and ecosystem benefits such as maintaining summer flow during dry periods, reducing flood in the winter, providing aquatic and riparian habitat, and improving downstream water quality. The study assumed that as LFD increases, groundwater reserves and soil moisture are depleted from meadows, reducing downstream benefits of meadows.

The results of the LFD analysis were graphed in a manner similar to those previously presented. As with the previous comparisons, the watersheds in the upper right quadrant are those that are valuable to ecosystem benefits (based on presence of mountain meadows) and which are also considered vulnerable to lengthened LFD as a result of the model simulations. The Stanislaus, Merced, and Tuolumne watersheds are all present in the upper right quadrant of Figure 3-8.

Figure 3-8: Relative Vulnerability Based on Meadow Area Per Square Kilometer and Change in LFD



Source: Null et al, 2010 – Figure 13, page 14
T2 – 2oC temperature increase
T4 – 4oC temperature increase
T6 – 6oC temperature increase

3.4.5 Climate Change Impacts on Groundwater

East Stanislaus Region Relation to Groundwater Basins

The East Stanislaus Region is underlain by the Modesto and Turlock Subbasins of the San Joaquin Valley Groundwater Basin. Many of the cities and water agencies/districts in the East Stanislaus Region depend solely or partly on groundwater as part of their water supply. The City of Modesto relies on groundwater, along with surface water purchased wholesale from Modesto Irrigation District, for its supplies, while the Cities of Ceres, Hughson and Turlock rely solely on groundwater. TID, MID, and OID use groundwater to augment their surface water supplies, while younger districts, such as the Eastside Water District, and areas outside major water service areas rely heavily on groundwater to meet their demands.

Potential Effects of Climate Change on the Groundwater Basins

Climate change impacts include more frequent and more severe droughts in the future. The droughts will equate to less precipitation and less recharge of the groundwater basins. With the lack of diversified water supplies in the region, the groundwater supplies may not be adequate to meet water demands and the greater the likelihood of overdrafting the groundwater basins and ultimately impacting water quality in the Modesto and Turlock subbasins. Currently, the East Stanislaus Region's water supplies are not very diversified. Users in the region rely mostly on groundwater with some surface water, which is to be expanded in the future, but should more frequent droughts occur, the region's water supplies may not be drought resistant. All of the impacts within the watersheds to the surface waters in the region will lead to similar impacts to the groundwater basins. The conjunctive management of groundwater and surface water in the future will be ever more important in the future and as climate change impacts increase.

3.5 Regional Water Resource Vulnerabilities

Climate change is adding new uncertainties to already existing challenges in water resources planning within the East Stanislaus IRWM planning region. There is not a widely-diversified water supply portfolio in the region. Water supplies are derived from multiple subbasins of the San Joaquin Valley Groundwater Basin (Modesto and Turlock Subbasins) and primarily from the Tuolumne River. Climate change will impact groundwater and surface water differently, but the Region's vulnerabilities are the same regardless of the source:

- Reduced surface water availability.
- Reduced water supply reliability as a result of reduced groundwater recharge and runoff.
- Potential increase in groundwater overdraft.
- Declining water quality.
- Loss of riparian habitat, wetlands and other sensitive natural communities.
- Reduced hydroelectric generation capacity.

The 2006 *Climate Action Team Report to Governor Schwarzenegger and the California Legislature* examined the Intergovernmental Panel on Climate Change (IPCC) data and determined that climate change could affect California in the following ways, among others:

1. Rising sea levels along the California coastline, including the San Francisco and San Joaquin Delta due to ocean expansion.
2. Extreme heat conditions, such as heat waves and high temperatures and associated increases in frequency and duration.

3. A reduction in the snowpack and stream flow from the Sierra Nevada, affecting water supplies.
4. An increase in the severity of winter storms, modifying peak stream flows and flooding.

These changes will occur concurrently with significant population increases. Population in California is expected to increase from 34 million to 59 million people by 2040 (ICF Jones & Stokes, 2009). Historically, cities within the East Stanislaus Region have seen extremely rapid growth, so it is expected the regional population will see more population increases at a fast rate.

Primary water users in the East Stanislaus IRWM region include urban users, agriculture, and the environment. Water supplies include both groundwater and surface water, with groundwater coming from the Modesto and Turlock Subbasins of the San Joaquin Valley Groundwater Basin and surface water being diverted primarily from the Tuolumne Rivers. Declining Sierra Nevada snowpack, earlier runoff, and reduced spring and summer streamflows will likely affect surface water supplies and shift reliance to groundwater resources, which are already on the verge of being overdrafted in some places. This will, in turn, affect critical natural resource issues in the region, such as agricultural land conversion, population growth, air, water and soil quality concerns, and loss of habitat land.

Other anticipated regional impacts resulting from climate change (increased air temperatures and variable precipitation) include changes to water quality; increased flooding, wildfires and heat waves; and impacts to ecosystem health. Earlier springtime runoff will increase the risk of winter flooding as capturing earlier runoff to compensate for future reductions in snowpack would take up a large fraction of the available flood protection space, forcing a choice between winter flood prevention and maintaining water storage for summer and fall dry-period use. Under the 'business-as-usual' climate change scenario (A2), wildfires could increase by 100% or more by the end of the century (CNRA, 2009). Some of these impacts on water resources management are already being observed within the region.

The identified vulnerabilities within the East Stanislaus Region are summarized in Table 3-4 and further described in the following sections.

Table 3-4: East Stanislaus Region Climate Change Vulnerabilities

Vulnerability	Description
Water Demand	Vulnerable to increased agricultural demands due to longer growing season, increased temperatures and evapotranspiration rates, and more frequent/severe droughts. Vulnerable to increased urban and commercial, industrial, and institutional (CII) demand due to increased outside temperatures.
Water Supply and Quality	Vulnerable to decreased snowpack in the Sierra Nevada, shifts in timing of seasonal runoff, increased demands creating groundwater overdraft, degraded surface and groundwater quality resulting from lower flows, exaggerated overdraft conditions, a reduction of meadows which can provide contaminant reduction, and more frequent/severe droughts and storm events increasing turbidity in surface supplies.
Flood Management	More severe/flashier storm events and earlier springtime runoff leading to increased flooding, and a reduction of meadows which help reduce floods in the winter.
Hydropower	Vulnerable to increased customer demand combined with changes in timing of seasonal runoff and flashier storm systems affecting reservoir storage.
Ecosystem and Habitat	Vulnerable to decreased snowpack, more frequent/severe droughts and wildfires, shift in seasonal runoff, increased low flow periods and increased water temperatures (degraded water quality).

3.5.1 Water Demand

Land use patterns in the East Stanislaus Region are dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crops, and nut and fruit trees, all of which rely heavily on water purveyors/districts and private groundwater and surface water supply sources. In general, irrigation water demand varies based on precipitation, and may or may not increase under future climate change conditions. Groundwater pumping is anticipated to increase as more irrigators and agricultural water users turn to groundwater to meet crop water requirements and farming needs (depending on surface water availability), and groundwater salinity increases with decreasing precipitation percolating to groundwater as a result of flashier and more variable precipitation events (Schoups et al., 2005). The effects of increased air temperatures on agriculture will include faster plant development, shorter growing seasons, changes to reference evapotranspiration (ET) and possible heat stress for some crops. In addition, fruit crops are more climate-sensitive than other crop types and may require additional water as the climate warms. Therefore, more water may be necessary to maintain yield and quality in future years of apricot or peach crops, for example, in the East Stanislaus Region.

If more water is required to maintain yield, and combined with potentially reduced supplies, the agricultural community may respond to these climate-induced changes primarily by increasing the acreage of land fallowing and retirement, augmenting crop water requirements by groundwater pumping, improving irrigation efficiency, and shifting to high-value and salt-tolerant crops (Hopmans et al., 2008). However, agricultural impacts resulting from climate changes are anticipated to be significant as Stanislaus County agricultural production had a value of around $9 billion in 2011 (Stanislaus County Agricultural Commissioner's Office, 2011). An example of potential impacts is on dairy production. Heat stress can have a variety of effects on livestock, including reduced milk production and reproduction in dairy cows (Valtorta, 2002). Based on modeling conducted by Hayhoe et al. and presented in their paper entitled *Emissions pathways, climate change and impacts on California* (Hayhoe et al., 2004), rising temperatures were found to reduce milk production by as much as 7 to 10% under the B1 scenario and by 11 to 22% under the A1 scenario.

With the exception of the City of Modesto, all urban users in the East Stanislaus Region depend solely on groundwater for their potable supplies. As noted above, climate change conditions may result in increased groundwater pumping by agricultural water users, and on a smaller scale for landscape irrigation, putting greater stress on the underlying groundwater subbasins and increasing competition for limited supplies. Additionally, increased variability in precipitation events and higher temperatures are expected to reduce groundwater recharge by reducing the amount of snowpack recharge that may occur and by increasing evaportranspiration (Dettinger and Earman, 2007). These too will result in greater completion for limited groundwater resources.

Other seasonal water uses, such as cooling demands, are also expected to increase as a result of climate change (DWR, 2008; CNRA, 2009). Identification of industrial cooling towers and similar facilities will help the region gain better understanding of the potential increases in seasonal demands.

In general, groundwater demands are highest during dry years, likely due to the fact that groundwater is primarily used for agricultural and landscape irrigation and as urban suppliers shift to groundwater as surface water supplies decrease; and these effects will be greater in Regions heavily dependent on groundwater for water supply. The seasonal variability of water demands is projected to increase with climate change as droughts become more common and more severe (DWR, 2008).

3.5.2 Water Supply and Quality

The East Stanislaus IRWM Region's water supplies include groundwater, local surface water, and imported surface water from the Central Valley Project (CVP). In general, impacts on urban users will be a function of behavioral response of individuals and organizations as well as hydrology (Hayhoe et al., 2004). Additional water storage will be required to ensure water supply reliability. Without additional storage, it will be difficult to capture and retain the extra runoff for use after April 1st without reducing the amount of flood storage space left in reserve. Both the need for empty storage for flood protection and the need for carryover storage for drought protection reflect the uncertainty about future weather conditions and the level of regional risk aversion (Hayhoe et al., 2004).

Currently, approximately 75% of total water use statewide currently occurs between April and September when lawns and crops are being irrigated (Hayhoe et al., 2004). Decreased summertime flows will likely result in increased groundwater pumping (and potential overdraft conditions) due to increased groundwater to offset surface water shortages. Additionally, rising temperatures are projected to increase the frequency of heat waves, which could also lead to increased water use and further exacerbate low flow conditions (Hayhoe et al., 2004).

Changes in water availability and timing will also affect the value of water rights statewide, as mid- and late-season natural stream flow water rights become less valuable and the value of rights to stored water (which has a higher degree of reliability) increase in value. Senior users without access to storage could face unprecedented shortages due to reduced summertime flows (Hayhoe et al., 2004). These same changes would also affect the level of hydropower generation on the Merced River, especially in the summer, when hydropower generation is needed most to meet peak demand (Moser et al., 2012).

Finally, climate change impacts may affect water quality in a multitude of ways.

- Water quality can be impacted by both extreme increases and decreases in precipitation. Increases in storm event severity may result in increased turbidity in surface water supplies while decreases in summertime precipitation may leave contaminants more concentrated in streamflows (DWR, 2008).

- Higher water temperatures may exacerbate reservoir water quality issues associated with reduced dissolved oxygen levels and increased algal blooms (DWR, 2008).

Water quality concerns not only impact drinking water supplies, but also environmental uses and wastewater treatment processes. The altered assimilative capacity of receiving waters may increase treatment requirements, and collection systems could be inundated in flooding events. More prevalent wildfires could result in aerial deposition and runoff of pollutants into water bodies, impacting surface water quality. Declining Sierra Nevada snowpack, earlier runoff and reduced spring and summer stream flows will likely affect surface water supplies and shift reliance to groundwater resources, which are already overdrafted in many places.

Groundwater Supply and Quality

The East Stanislaus Region overlies two groundwater subbasins within the San Joaquin Valley Groundwater Basin, the Modesto and Turlock Subbasins.

The Modesto Groundwater Subbasin is the primary source of water for many of the urban and private, rural domestic water systems overlying the groundwater basin. Groundwater levels in the subbasin decreased in the eastern and central Modesto area until the 1990s when a series of wet years occurred and the regional surface water treatment plan was completed, transferring a portion of the City's demand to surface water. In recent years, groundwater levels in the subbasin have recovered and generally remain steady. Municipal (City of Modesto service area) and agricultural groundwater use (MID service area) in 2009 was estimated to be 55,779 acre-feet per year or AFY (MID, 2012). This number is likely higher due to reliance on groundwater for supply in areas outside the public water system service area.

Groundwater quality in the Modesto Subbasin ranges from mostly good in the unconfined aquifer to poor in some areas of the confined aquifer (MID, 2012). Total Dissolved Solids (TDS) in groundwater in the eastern two-thirds of the basin is generally less than 500 mg/L, with a range from 90 mg/L to 700 mg/L. High TDS (2,000 mg/L) groundwater is present beneath the MID service area at a depth of about 400 feet in the west to about 800 feet in the east. This degraded water originates in marine sediments underlying the San Joaquin Valley. The shallowest high TDS groundwater (TDS greater than 1,000 mg/L) occurs around 120 feet below ground within a 5- to 6-mile zone parallel to the San Joaquin River. (MID, 2012).

The Turlock Groundwater Subbasin is also the primary source of water from most of the urban and private, rural domestic water systems overlying the subbasin. Municipal groundwater use for 2006, the last year the cumulative municipal pumping data were available for the subbasin, was approximately 46,000 AFY (TGBA, 2008), all of which was extracted from the confined aquifer. In addition, rural and small private residential groundwater use is estimated at 5,500 AFY while TID groundwater extractions are estimated to be 84,174 AFY (TID, 2012), and private pumping within TID is approximately 22,000 AFY (TGBA, 2008). Agricultural lands to the east of TID's irrigation service area rely entirely on groundwater for water supply. Farmers within Eastside and Ballico-Cortez Water Districts typically use an estimated 180,000 AFY of groundwater for irrigation (TGBA, 2008). Agricultural lands located along the river margins and east of Eastside and Ballico-Cortez Water Districts typically pump an estimated 115,000 AFY. However, similar to the Modesto Subbasin, the overall volume of groundwater extracted in a given year is likely higher than estimated pumpage due to reliance on groundwater for supply in areas outside the public water system service areas.

Historically, groundwater elevations have been relatively steady throughout the Turlock Subbasin, which relies on surface water supplies from the Tuolumne River for recharge. The subbasin has historically experienced seasonal fluctuations in groundwater levels and declines occurring during dry cycles, with groundwater levels rebounding in wetter years. On the eastern side of the basin, where surface water supplies are not available, a cone of depression began forming in the 1970s, resulting in groundwater declines on the eastern side of TID. The cone of depression appeared to have stabilized in the 1990s and early part of this century as growers on the east side converted to more advanced irrigation practices, reducing runoff and improving irrigation efficiencies. However, groundwater level declines appear to have resumed in the area in recent years. Local agencies are concerned that groundwater levels will continue to decline as additional range land is converted to groundwater irrigated agriculture in the foothill areas (TGBA, 2008).

In terms of groundwater quality, shallow groundwater in the Turlock Subbasin does not meet drinking water standards but can be used for non-potable uses. Groundwater from deeper aquifers is generally of high quality (TGBA, 2008).

For both subbasins, the variation in precipitation and streamflow in the future will influence how and when the groundwater subbasins are recharged in the East Stanislaus Region.

Surface Water Supply and Quality

The Central Valley Regional Water Quality Control Board (RWQCB) compiled the 303(d) list of impaired water bodies within the Sacramento River and San Joaquin River Basins that suffer significant water quality impairments from a variety of pollutants and must be addressed through the development of Total Maximum Daily Loads (TMDLs). The Lower Stanislaus River, the Lower Tuolumne River (from Don Pedro Reservoir to the San Joaquin River), and the Lower Merced River (from McSwain Reservoir to the San Joaquin River) are included on this list. Irrigated agriculture has been identified as an anthropogenic source of pesticides, nitrate and sediment loading in surface water bodies. Additional sources of sediment loading include erosion, mining, and grazing, among others. Current climate change scenarios project lower stream flows and higher agricultural water use that would pose significant challenges in implementing the defined TMDLs and meeting water quality goals.

As the occurrence of wildfires increases, additional sediment would be deposited into water bodies, and turbidity would likely become more of a concern. Sediment and pollutants collected from upstream could be concentrated downstream, leading to water quality issues and the disturbance of critical habitats. In addition, earlier snowmelt and more intense precipitation events will likely increase turbidity in source waters. Shifts in the timing of runoff have already been observed; over the last one hundred years the fraction of total annual runoff occurring between April and July has decreased by 23% in the Sacramento Basin and by 19% in San Joaquin Basin (CEC, 2008). Increased flooding may lead to sewage overflows, resulting in higher pathogen loading in the source waters. Increased water temperatures and shallower reservoirs may result in more prevalent eutrophic conditions in storage reservoirs, increasing the frequency and locations of cyanobacterial blooms. These potential changes could result in challenges for surface water treatment plants and require additional monitoring to quantify changes in source water quality and better control of finished water quality (CUWA, 2007).

Imported Surface Water Supply

Imported supplies from the Central Valley Project (CVP) are delivered to users in Stanislaus County through contracts with the United States Bureau of Reclamation (USBR) (Stene, 1994). Much of this water is delivered via the Delta-Mendota Canal to users outside the East Stanislaus IRWM Region though a small portion is utilized by Oakdale Irrigation District.

Due to delivery reductions by the USBR, the long-term average annual available CVP supply for agricultural and municipal and industrial (M&I) usage is estimated to be 53% and 83% of the contracted amount, respectively. On December 15, 2008, the U.S. Fish and Wildlife Service (USFWS) released its final Biological Opinion on CVP and State Water Project (SWP) Operations Criteria and Plan (OCAP); the results of this study could also impact the long-term availability of CVP supplies.

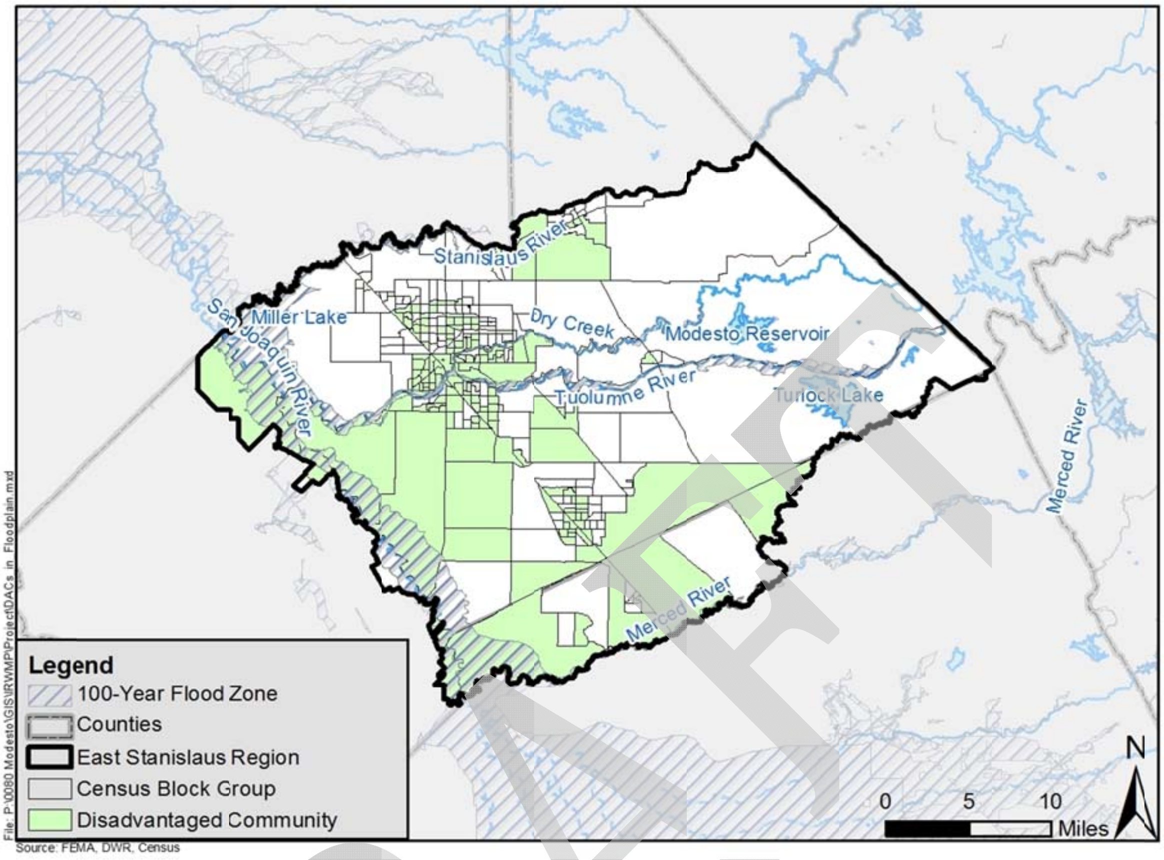
As a result of the increased temperature, DWR anticipates a 20% to 40% decrease in the state's snowpack by mid-century (DWR, 2008). This reduction in snowpack impacts the SWP, CVP and water systems that rely on the Colorado River. The SWP 2009 Delivery Reliability Report (DWR 2010c) indicates that Delta exports may be reduced by up to 25% by the end of the century.

3.5.3 Flood Management

Sea level rise is not a direct potential climate change impact to the East Stanislaus Region, but if sea level rise occurs, the salinity of the Delta may increase, impacting reservoir operations in the Region and resulting in the potential need for freshwater releases from tributaries of the Lower San Joaquin River, including the Stanislaus, Tuolumne and Merced Rivers. In addition to increased coastal flooding resulting from sea level rise, severity of non-coastal flooding will also increase in the future due to climate change. Extreme precipitation events will become more common, increasing the likelihood of extreme weather events and floods. Rising snowlines will also increase the surface area in watersheds receiving precipitation as rain instead of snow (DWR, 2008), thereby increasing storm-related runoff. Flooding has been a major problem throughout the history of Stanislaus County, particularly with the encroachment of urban growth into flood plains. Major floods have occurred in 1861, 1938, 1950, 1966 and 1969. Significant flooding also occurred in 1983 along the San Joaquin River, in isolated stretches of the Tuolumne River, and on smaller creeks such as Salado Creek (Stanislaus County, 2013). These events could increase under anticipated future conditions.

In general, a majority of the San Joaquin River's 100-year floodplain (in this stretch of the San Joaquin River) is within the East Stanislaus Region, but overall, not much of the East Stanislaus Region is described as being within a Federal Emergency Management Agency (FEMA) designated 100-year floodplain. Low-lying disadvantaged communities (DACs) will be particularly vulnerable to flooding damages causing temporary and/or permanent displacement. Some of the DACs within the East Stanislaus Region lie within the 100-year floodplain as shown in the following figure.

Figure 3-9: DACs within 100-year Floodplain



3.5.4 Ecosystem and Habitat

The San Joaquin River National Wildlife Refuge (SJRNWR) is located in Stanislaus County at the juncture of the San Joaquin, Tuolumne and Stanislaus Rivers. Although the majority of the refuge is located west of the East Stanislaus Region, a portion of the refuge is located within the Region. The SJRNWR encompasses over 7,000 acres of riparian woodlands, wetlands and grasslands that host a diversity of wildlife native to California's Central Valley and has played a major role in the recovery of the Aleutian cackling geese. Located adjacent to the Refuge and within the East Stanislaus Region is Dos Rios Ranch. This historic property was acquired by the Tuolumne River Trust and River Partners, and is a collaborative restoration project headed by the two non-profits with other federal, state and local partners. Dos Rios Ranch consists of 1,600 acres of biologically rich floodplain, including three miles of riverfront on the San Joaquin River and three miles on the Tuolumne River. The habitats, and the species that inhabit them, are susceptible to heat waves, droughts, and flooding and may be in danger (CCSP, 2009).

Climate change impacts on the environment within the East Stanislaus Region also include changes in vegetation distribution and increases ecosystem stress. Specifically, temperature-induced declines in alpine/subalpine forests are expected to occur, in addition to major shifts from evergreen conifer forests to mixed evergreen conifer forests and expansion of grasslands (Hayhoe et al., 2004). Increasing stress on ecosystems resulting from rising temperatures will reduce capacity to resist pest attacks while increasing pest survival rates, accelerating their development and allowing them to expand their range. Increasing temperatures will also result in warmer freshwater temperatures which, along with changes in seasonal stream flows, are projected to cause sharp reductions in salmon populations and increased risks of extinction for some Central Valley subpopulations (Ackerman and Stanton, 2011).

Projected hotter and possibly drier future conditions will also increase the frequency and extent of wildfires, worsen pest outbreaks, and stress precarious sensitive populations. Wildfires will play a significant role in converting woodlands to grassland as decreases in moisture shift the competitive balance in favor of the more drought-tolerant grasses and increases in grass biomass provide more fine fuels to support more frequent fires. Increased wildfires also favor grasses, which re-establish more rapidly than slower growing woody life forms after burning (Hayhoe et al., 2004)

Finally, should there be decreases in precipitation, both surface water and groundwater quality could be affected. Warmer surface water would result in lower dissolved oxygen concentrations, which can directly impact aquatic and riparian habitats. Decreased precipitation and associated decreased groundwater percolation would result in increased dissolved concentrations of constituents in groundwater.

3.5.5 Hydropower

Modesto Irrigation District and Turlock Irrigation District has been generating and delivering wholesale electric power from the Don Pedro Hydroelectric Project since 1923, with TID as the majority owner and operating partner. The powerhouse can generate up to 203 MW of electrical power from its four generators. Oakdale Irrigation District is a partner on the Tri-Dam Project, which manages the Tulloch, Beardsley and Donnells Reservoirs on the Stanislaus River. The combined storage capacity of the three reservoirs is 230,400 AF, with a combined power generation of 81,000 kilowatts.

New Melones Reservoir on the Stanislaus, New Don Pedro Reservoir on the Tuolumne and New Exchequer Reservoir on the Merced River, along with their downstream reservoirs) are supplied primarily by snowmelt from the Sierra Nevada. Changing volumes of snowfall and snowpack in the Sierra Nevada and the changing seasonal melting patterns may require changes in dam operation. As the timing of snowmelt shifts in the spring, hydroelectric power generation may also shift to accommodate enhanced flood control operations. Additionally, increasing temperatures will also increase energy demands, especially during peak demand times (DWR, 2008). As previously described, the modeling completed as described in the *Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada*, showed that runoff centroid timing (CT) on the Merced River was 2 weeks, 4 weeks, and 6 weeks earlier given the respective 2°C, 4°C, and 6°C increases in air temperature, respectively. Change in seasonal runoff timing may affect electrical generation capabilities, flood protection, water storage and deliveries. Hydropower is often generated during high demand periods, which may be compromised if facilities are forced to spill due to higher magnitude flows or to accommodate early arrival of flows (Null, et. al., 2010).

3.5.6 Other

Climate change will also affect the Region in other ways, including impacting recreation and tourism industries (and therefore the Region's economy). The Tuolumne River, along with the Merced River, is prominent waterways in Yosemite National Park, and communities downstream of the park rely on this industry as part of its economy. Stressed environments and increased wildfire will put these natural resources at risk. Projections of decreased snowpack have the potential to affect the ski industry as the State's 34 ski resorts are based between 6,500 and 8,200 feet, well into the elevations impacted by temperature increases. These same temperature increases will also delay the start of ski season and impact the economic viability of the industry (Hayhoe et al., 2004).

3.5.7 Prioritized Vulnerabilities

The East Stanislaus Region's vulnerabilities to anticipated climate changes were prioritized based on discussions with the East Stanislaus IRWM Steering Committee (SC) and Public Advisory

Committee (PAC) and considering regional understanding and sensitivities and identified regional goals and objectives. The prioritized vulnerabilities for the Region were as follows:

1. Water Supply/Water Quality
2. Flood Management

Secondary priorities included ecosystems and habitat, water demand, and hydropower.

The rationale behind the prioritization acknowledges that, while the groundwater basin appears to be relatively stable, it could easily slip into overdraft conditions, and that additional water supply reductions could induce this condition. Similarly, flooding and flood management is a major issue for the portion of the Region adjacent to the San Joaquin River, and flashier river/stream systems is only going to worsen this condition, create new flooding conditions at other locations, and significantly impact hydropower operations (as would significant changes in river flows resulting from earlier springtime runoff and/or lower annual flows). Increasing water demands will also make the water supply conditions worse. And finally, while ecosystem and habitat issues are important, they derive from the other issues/vulnerabilities (e.g., water supply and quality, which is exacerbated by demand and flood issues), therefore ranking a lower vulnerability.

3.6 Climate Change Adaptation and Mitigation

Global climate modeling carries a significant degree of uncertainty resulting from varying sensitivity to changes in atmospheric forcing (e.g. CO_2, aerosol compounds), unpredictable human responses, and incomplete knowledge about the underlying geophysical processes of global change. Even though current scenarios encompass the “best” and “worst” cases to the greatest degree possible based on current knowledge, significant uncertainty associated with future global GHG emission levels remains, especially as timescales approach the end of the century. The historical data for calibrating GCMs is not available worldwide, and is spatially biased towards developed nations.

Considering the great deal of uncertainty associated with climate change projections, a prudent approach to addressing climate change incorporates a combination of adaptation and mitigation strategies. Climate adaptation includes strategies (policies, programs or other actions) that bolster community resilience in the face of unavoidable climate impacts (CNRA and CEMA, 2012), where mitigation strategies include best management practices (BMPs) or other measures that are taken to reduce GHG emissions.

The Prop 84 IRWM Guidelines require consideration of the *California Water Plan* (CWP) resource management strategies (RMSs) in identifying projects and water management approaches for the region. RMSs are being considered in the East Stanislaus IRWM planning process to meet the region’s objectives. Application of various RMSs diversifies water management approaches, and many of the RMSs apply to climate change adaptation and mitigation. Categories of applicable RMSs include:

- Reduce Water Demand
- Improve Operational Efficiency and Transfers
- Increase Water Supply
- Improve Water Quality
- Urban Runoff Management
- Practice Resource Stewardship
- Improve Flood Management
- Other Strategies

Within each RMS category listed above, a variety of specific RMSs have been identified for the region. For example, reducing water demand can be accomplished through agricultural water use efficiency and/or urban water use efficiency. As described in the *Climate Change Handbook for Regional Planning* (CDM, 2011), not all of the RMSs directly apply to climate change adaptation or mitigation, but are directed at overall system resiliency, which improves a system's resilience to the uncertain conditions climate change could bring.

3.6.1 Adaptation Strategies

The following table summarizes the ability of individual RMSs to aid in climate change adaption.

The application of the RMS that are applicable within the East Stanislaus Region as climate change adaptation strategies are described in the following sections.

Reduce Water Demand

Reducing existing and future water demands can reduce pressure on water sources of limited supply and help adapt to the potential climate change impacts of less precipitation, shifting of springtime snowmelt, and overall uncertainty. The Reduce Water Demand RMS includes both agricultural and urban water use efficiency. Opportunities for increased water conservation and water use efficiency measures for urban and agricultural water use are identified in multiple documents including the *CWP Update*, the Agricultural Efficient Water Management Practices, the *California 20x2020 Water Conservation Plan* (20x2020 Plan), and by the California Urban Water Conservation Council. These recommendations could potentially be incorporated into the existing framework already developed by cities and water agencies within the East Stanislaus Region. Performance metrics that could be used to measure the effectiveness of Reduce Water Demand adaptation include average water demand reduction per year and peak water demand reduction per month (CDM, 2011).

Table 3-5: Applicability of RMS to Climate Change Adaptation

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Sea Level Rise	Water Quality Protection	Hydropower
Reduce Water Demand								
Agricultural Water Use Efficiency			✓		✓		✓	
Urban Water Use Efficiency			✓		✓		✓	
Improve Operational Efficiency and Transfers								
Conveyance-Delta*	✓	✓	✓	✓		✓	✓	
Conveyance-Regional/Local	✓	✓	✓	✓			✓	
System Reoperation		✓	✓	✓				✓
Water Transfers			✓	✓				
Increase Water Supply								
Conjunctive Management and Groundwater Storage		✓	✓	✓			✓	
Desalination*			✓	✓				
Precipitation Enhancement*				✓				✓
Recycled Municipal Water			✓	✓				
Surface Storage-CALFED*	✓	✓	✓	✓			✓	✓
Surface Storage-Regional/Local	✓	✓	✓	✓			✓	✓
Improve Water Quality								
Drinking Water Treatment and Distribution			✓	✓			✓	
Groundwater Remediation/Aquifer Remediation			✓	✓			✓	
Matching Quality to Use			✓	✓			✓	
Pollution Prevention	✓		✓				✓	
Salt and Salinity Management	✓		✓	✓			✓	
Urban Runoff Management	✓	✓					✓	
Practice Resource Stewardship								
Agricultural Lands Stewardship	✓	✓			✓		✓	
Economic Incentives	✓	✓	✓	✓	✓	✓	✓	✓
Ecosystem Restoration	✓	✓	✓			✓	✓	
Forest Management	✓	✓	✓				✓	
Land Use Planning and Management	✓	✓				✓	✓	
Recharge Area Protection		✓	✓	✓			✓	
Water-dependent Recreation	✓	✓	✓				✓	
Watershed Management	✓	✓	✓	✓		✓	✓	✓
Improve Flood Management								
Flood Risk Management	✓	✓				✓	✓	✓
Other Strategies								
Crop Idling for Water Transfers*			✓	✓	✓			
Dewvaporation or Atmospheric Pressure Desalination*				✓				
Fog Collection*				✓				
Irrigated Land Retirement*			✓		✓			
Rainfed Agriculture*					✓			
Waterbag Transport/Storage Technology*	✓		✓	✓		✓	✓	

* RMS deemed inappropriate for the East Stanislaus IRWM Region at this time. See Chapter 5 of this IRWMP for more detail.

Agricultural Water Use Efficiency

The East Stanislaus Region is already implementing many agricultural water use efficiency efforts. For example, both MID and TID, the Region's primary agricultural water suppliers, have identified and are currently implementing efficient water management practices (EWMPs) as part of their Agricultural Water Management Plan. The Agricultural Water Management Council (AWMC) suggests several EWMPs that include infrastructure upgrades and operational improvements in order to reduce water demand and maintain productivity. While many of these EWMPs may have already been implemented in the Region, there may be opportunities to further implementation of EWMPs such as:

- **Infrastructure Upgrade:** Evaporation loss from irrigation ditches and canals is a function of temperature and other climate variables. Depending on different emission scenarios, the operation of these facilities may be impacted by climate change, leading to increased water loss. One of the AWMC EWMPs is to convert irrigation canals and ditches to piping. This water conservation method prevents evaporative losses, which will only increase as temperatures rise. This approach could help the East Stanislaus Region adapt to climate change by expanding water supplies and making existing water supplies less vulnerable to climate change impacts. Canal lining is identified as a less capital-intensive method to reduce seepage into the ground, although it does not reduce water evaporation and does reduce groundwater recharge that occurs as a result of this seepage. Canal automation can increase water supply reliability and flexibility to deliver water at the time, quantity, and duration required by the grower, and can facilitate conversion to more efficient irrigation methods such as micro-irrigation.
- **Water Management:** Water suppliers and users must take advantage of new technologies and hardware to optimize management of water-related infrastructure. Supervisory control and data acquisition (SCADA) systems enable water managers to collect data to a centralized location and operate automated canals to achieve desired water levels, pressures or flow rate, and also increase the efficiency in reservoir operation. In addition, automated control will free water system operators from manual operation and allow them to plan, coordinate system operations, and potentially reduce costs. Such systems improve communications and provide for flexible water delivery, distribution, measurement, and accounting. On-farm practices can also be improved. Furrow, basin, and border irrigation methods have been improved to ensure that watering meets crop water requirements while limiting runoff and deep percolation. Using organic or plastic mulch can reduce non-essential evaporation of applied water. Advanced irrigation systems include GIS, GPS and satellite crop and soil moisture sensing systems and can all improve overall farm water management.

As previously noted, agricultural irrigation has been linked to groundwater recharge in the East Stanislaus Region; reductions in irrigation could result in a reduction in basin recharge. This linkage must be considered in the implementation of any management practice that may result in the reduction of agricultural irrigation.

Urban Water Demand Reduction

The 20x2020 Plan includes urban water conservation measures that can be employed to improve water use efficiency. According to the 20x2020 Plan, approximately one third of urban water use is dedicated to landscape irrigation; as such, the greatest potential for urban water use reduction is in reduced landscape irrigation. New landscapes could be designed to be efficient and suitable for the local climate, and existing high-water-using landscapes could be transformed into lower, more efficient alternatives. Weather-based irrigation is a cost-effective measure to improve landscape watering efficiency. Irrigation restrictions can limit landscape irrigation to two days per week or less, encouraging climate-appropriate landscapes and reducing over-irrigation. The 20x2020 Plan also recommends mandating the landscape irrigation BMPs and requiring water-efficient landscapes at all state-owned properties (DWR, 2010b).

Improve Operational Efficiency and Transfers

Water supply system operations need to be optimized in order to maximize efficiency. Existing infrastructure for regional and local conveyance, including facilities that connect to the CVP system, must be maintained and improved as their useful lives are reached. Well-maintained conveyance infrastructure improves water supply reliability and enhances regional adaptability to climate change impacts. Addressing aging infrastructure, increasing existing capacity, and/or adding new conveyance facilities can improve existing conveyance systems and operational efficiency.

Through changes in water supply system operations, the East Stanislaus Region may be able to adapt to less reliable water supplies and/or increased water demands by maintaining conveyance infrastructure, as well as adapting to climate change impacts on hydropower production, flooding, habitat, and water quality.

The Region is currently investigating and implementing water transfers and interagency sales. Specifically, the City of Modesto and MID have an MOU formalizing sale of treated surface water to the City for use in lieu of groundwater. Additionally, the Cities of Modesto and Turlock are looking to develop and program to sell tertiary-treated wastewater effluent to Del Puerto Water District for use in lieu of surface water supplies for irrigation. This will help the Region adapt to climate change by providing additional climate resilient water supplies. As such, transfers and sales can improve supply reliability when other supplies are projected to have reduced reliability due to climate change impacts.

An example of a performance metric to quantify this RMS, Improve Operational Efficiency and Transfers, includes amount of new supply created through regional water transfers and sales (CDM, 2011).

Increase Water Supply

As water demands increase due to longer growing seasons, higher temperatures, and longer droughts, and the future of existing water supplies sources becomes less certain, the East Stanislaus Region will need to enhance existing water supplies to meet demands. Increasing water supply can be accomplished through the implementation of conjunctive management of surface and groundwater supplies as well as through groundwater storage, recycled water use, and increased surface water storage, as appropriate. Diversifying the region’s water supply portfolio and adding drought-resistant sources is an adaptation measure that will help address increased water demands and/or decreased supply reliability. Performance metrics for measuring the effectiveness of the Increase Water Supply RMS could include additional supply created, amount of potable water offset, and supply reliability (CDM, 2011).

Conjunctive Management and Surface and Groundwater Storage

Turlock Groundwater Basin Association (TGBA) developed and has been implementing the *Turlock Groundwater Basin Draft Groundwater Management Plan*, which promotes conjunctive surface water and groundwater management to improve the long-term sustainability of the Turlock Groundwater Subbasin. The Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA) has also recommended groundwater management and conjunctive use as a strategy in its *Integrated Regional Groundwater Management Plan for the Modesto Subbasin* for ensuring the long-term sustainability of the Modesto Groundwater Subbasin. Members of the ESRWMP are active members of both the TGBA and STRGBA, and as such, have recognized the potential benefits regional planning would create when considering surface water and groundwater management in the basin. The East Stanislaus Region should continue to investigate conjunctive management to increase surface and groundwater use, improve groundwater quality, and adapt to climate change. Increased storage and conjunctive use may increase resilience to shifting runoff patterns, providing more storage for early runoff, reducing or eliminating the potential climate change impacts on flooding and hydropower production, and offsetting decreases in snowpack storage. This strategy is valuable as weather patterns change in frequency and timing and more extreme events occur.

Developing a project to provide additional local surface storage is a possible adaptation strategy for climate change impacts on water supply and associated reliability. Storage provides a way of adjusting a water system to altered peak streamflow timing resulting from earlier snowpack melting. Additional storage capacity could also help the East Stanislaus Region adapt to the anticipated increased precipitation variability. Increased surface storage could allow water managers to make real-time decisions that are not available otherwise. It would also facilitate water transfers between basins from upstream reservoirs to receiving regions that have additional storage for the transferred water. Added storage provides greater flexibility for capturing surface water runoff, managing supplies to meet seasonal water demands, helping manage floods from extreme storm events, and adapt to extreme weather conditions such as droughts.

In addition to new storage, agencies could continue considering developing additional water purchasing agreements to buy water from other agencies that own existing storage reservoirs with substantial water supplies. Rehabilitation and possible enlargement of existing dams and infrastructure can potentially eliminate the need for new reservoir storage.

Finally, implementing conjunctive management and groundwater storage can provide benefits similar to additional surface storage, in addition to increased water management flexibility while also reducing groundwater overdraft. There is the potential to bank imported water, flood flows, runoff, recycled water, and/or desalinated water for dry seasons in groundwater basins. Conjunctive management is highly dependent on how well surface water and groundwater are managed as a single source to adapt to the climate system.

Desalination

Because the East Stanislaus Region is not a coastal region, desalinating seawater is not an option and therefore not a reasonable climate change adaptation strategy. Desalination of deep connate groundwater is a possibility; however, the potential for land subsidence and brine discharge pose significant challenges to implementing this as a cost-effective adaptation strategy.

Recycled Water Use

The California Recycled Water Policy, developed by the State Water Resource Control Board in 2009, includes a goal of substituting as much recycled water for potable water as possible by the year 2030. Recycled water is a sustainable, climate resilient local water resource that could significantly help the East Stanislaus Region meet water management goals and objectives, and assist in meeting the seasonal water demands of agriculture. Water recycling also provides a local supply that generally uses less energy than other water supplies, helping to mitigate climate change impacts through associated GHG emissions. Recycled water could be used for agricultural and urban landscape irrigation in lieu of surface water and groundwater supplies.

Improve Water Quality

Improving drinking water treatment and distribution, groundwater remediation, matching water quality to use, pollution prevention, salt and salinity management, and urban runoff management can help improve surface and ground water quality. These strategies may help a region adapt to drinking water and ecosystem-related water quality impacts from climate change. They may also contribute to providing additional supplies; for example, stormwater capture and reuse would reduce pollution and also provide a seasonal source of irrigation water for urban landscaping or groundwater recharge. Similarly, improved treatment of wastewater effluent discharges will minimize the water treatment needs for downstream diversions. Water quality performance metrics for this RMS could include stream temperature, dissolved oxygen content, and pollutant concentrations (CDM, 2011).

Drinking Water Treatment and Distribution

Climate change impacts can pose challenges for surface water treatment plants in a number of ways, including increased monitoring and treatment flexibility necessary to quantify and treat for source water quality changes in order to maintain finished water quality. Continued growth statewide will result in increased stress on the limited water resources available for domestic, agricultural, and industrial uses. Improving water treatment technologies and matching quality to end use can provide the flexibility required to meet uncertain future conditions.

Groundwater Remediation

Removing contaminants and pollutant plumes in current groundwater sources will provide additional water supply by allowing an otherwise unusable source to become usable. Combined with matching water quality and quantity to water demand type, this adaptation strategy will help reduce the need for imported water supplies with higher capital costs and greater associated GHG emissions.

Local government and agencies with land use responsibility should limit potentially contaminating activities in areas where recharge takes place (recharge zone protection) and work together with entities currently undergoing long-term groundwater remediation to develop a sustainable, long-term water supply for beneficial reuse.

Pollution Prevention

In recent years, as point sources of pollution have become regulated and controlled, "non-point source" (NPS) pollution has become a primary concern for water managers. NPS pollution is generated from land use activities associated with agricultural development, forestry practices, animal grazing, uncontrolled urban runoff from development activities, discharges from marinas and recreational boating activities, and other land uses that contribute pollution to adjacent surface and groundwater sources.

Pollution prevention and management of water quality impairments should incorporate a watershed approach. DWR recommends the following approach to reduce NPS pollution to existing surface and groundwater sources:

1. Establish drinking water source and wellhead protection programs to shield drinking water sources and groundwater recharge areas from contamination.
2. Identify communities that rely on groundwater contaminated by anthropogenic sources as their drinking water source and take appropriate regulatory or enforcement action against the responsible party.
3. Address improperly destroyed, abandoned, or sealed wells in these communities that may serve as potential pathways for contaminants to reach groundwater.

Protecting water supply sources will help to ensure the long-term sustainability of those supplies.

Salt and Salinity Management

Accumulation of salts in soil can impair crop productivity, making salinity management a critical concern for the Region's highly productive agricultural industry. Salinity management strategies establish or improve salinity management in the Region based on an understanding of salt loading and transport mechanisms. Several potential benefits of establishing or improving salt and salinity management include protecting water resources and improving water supplies, securing, maintaining, expanding, and recovering usable water supplies, and avoiding future significant costs of treating water supplies and remediating soils. Salt and salinity management strategies identified by the *California Water Plan Update 2009* include:

- Developing a regional salinity management plan, and interim and long-term salt storage, salt collection, and salt disposal management projects;
- Monitoring to identify salinity sources, quantifying the level of threat, prioritizing necessary mitigation action, and working collaboratively with entities and authorities to take appropriate actions;
- Reviewing existing policies to address salt management needs and ensure consistency with long-term sustainability; and
- Collaborating with other interest groups to optimize resources and effectiveness;
- Identifying environmentally acceptable and economically feasible methods for closing the loop on salt.

The Central Valley Salinity Alternatives for Long-term Sustainability initiative (CV-SALTS), a collaborative effort initiated in 2006 by the Central Valley Salinity Coalition, was created to find a solution to the rising salt levels in the Central Valley that have the potential to impact drinking water quality and productive crops throughout the basin. It is the Salt and Nutrient Planning effort in the Central Valley region as indicated by the RWQCB. The City of Modesto has been participating in CV-SALTS and plan on continuing its membership. The Region continues managing salt and applying this RMS through participation in CV-SALTS, as well as other methods. The CV-SALTS effort will identify specific salt and salinity challenges within the region and strategies to help adapt to climate change by mitigating potential salinity increases associated with climate change.

Urban Runoff Management

Urban runoff management, including Low Impact Development (LID), encompasses a broad range of activities to manage both stormwater and dry weather runoff. Stormwater capture and reuse projects can reduce the burden on wastewater treatment plants and potable water supplies, helping a region adjust to climate change impacts on water quality and water supply (CDM, 2011). The East Stanislaus Region should investigate and implement LID techniques and opportunities where appropriate and integrate urban runoff management with other RMSs.

Improve Flood Management

Increased frequency and severity of storm events will require the East Stanislaus Region to collaborate on and accelerate flood protection projects in order to adapt to increased flooding risks due to climate change. Flood management involves emergency planning, general planning activities, and policy changes. Improving flood management can help a region adapt to not only potential flooding, but many other climate change impacts, including ecosystem and water quality vulnerabilities. Performance metrics could include acres of meadows restored or volume of natural flood storage provided (CDM, 2011).

The East Stanislaus Region, as part of its IRWM planning process, is currently participating in the development of a Regional Flood Management Plan for the Mid-San Joaquin Region to identify potential projects that may improve flood management. This plan is scheduled to be completed in the end of 2014. The Regional Flood Management Plan will formulate feasible projects, assess the performance of the projects, and develop a plan that reflects the vision of local entities in reducing flood risks in their region. The Plan will help identify strategies to implement to contribute to this RMS and will aid the region in adapting to climate change impacts.

Structural Improvement

One possible approach to providing flood protection will be for local flood jurisdictions to establish long-term buyback programs to acquire properties immediately adjacent to levees and other structural facilities to facilitate the eventual removal or relocation of these structures, and enhance the potential for setback levees and floodplain restoration where feasible. Possible structural projects should be integrated into a comprehensive integrated flood management program that takes a watershed approach (DWR 2009). This RMS is something the Region may consider in the future as part of a larger flood management program.

Land Use Management

General plans should be updated to reflect increased future flood risks; these should be updated as hydrologic projections change. Land use elements should identify and review flood-prone areas established by FEMA or DWR. Also, revised general plans and regulations should reflect an integrated flood management approach and consider future development on tribal lands.

Local land use agencies should not allow new critical public facilities to be constructed within the 200-year floodplain. Existing critical facilities located in flood-prone areas should be noted in the Emergency Plans prepared by local agencies, with evacuation routes clearly identified.

Promoting the preservation of existing floodplains, restoration of natural floodplain functions where feasible, and careful analysis of the interface between natural floodplains and flood management structures can help prevent erosion and debris deposition from creating undue hazards to downstream facilities and property (DWR, 2009).

Disaster Preparedness, Response, and Recovery

The vulnerability assessment previously described helps identify the resources that are most susceptible to climate change impacts. Flood control districts and other relevant jurisdictions should analyze potential flood risks and make this information publicly available. The public should be provided with sufficient information about potential flood risks to make informed decisions that safeguard their lives, property, and critical facilities. Flood control districts should also incorporate the potential effects of climate change into planning for future flood events. Until more refined projections are developed, DWR recommends using a 20% higher peak flow reference for planning purposes (DWR, 2009).

Practice Resource Stewardship

Resource stewardship includes overseeing and protecting land, wildlife, and water by way of conservation and preservation, coordination of compatible land uses, ecosystem management and restoration, watershed management, flood attenuation, and water-dependent recreation. Restoring and preserving habitat and wetlands has multiple benefits, including promoting biodiversity and habitat enhancement as well as improved flood management as the natural storage provided by riparian wetlands can serve as buffers that absorb peak flows and provide slow releases after storm events (DWR, 2008). Coordination of land uses can promote multi-faceted land stewardship by identifying and encouraging compatible land uses such as agriculture, natural resource management, open space and outdoor recreation. Because the scope of resource stewardship includes all resources, these strategies can help adapt to climate change impacts in various ways, depending on project-specific details (CDM, 2011).

Agricultural Resource Stewardship

The Stanislaus County General Plan provides policies for the protection and management of agricultural lands, including policies to ensure that lands designed for agriculture are restricted to compatible uses such as natural resource management, open space, outdoor recreation and scenic beauty (Stanislaus County, 2013). Counties should adopt agricultural general plan elements and designate supportive agricultural districts that enhance agricultural land stewardship on high priority, productive agricultural lands. The focus of these districts should be for:

- Regulatory assistance through county agricultural ombudsmen;
- Local agricultural infrastructure investment, marketing assistance, and the development of agricultural lands stewardship practices and strategies in cooperation with local, State and federal agricultural conservation entities;
- Land protection instruments, such as the Williamson Act and agricultural conservation easements; and
- Engagement of resource organizations such as resource conservation districts, the American Farmland Trust, and Ag Futures Alliances (via Ag Innovations Network), and be integrated with IRWMPs and habitat conservation plans where appropriate.

This recommendation should be implemented over the long-term as each county general plan is updated (CDM, 2011).

Ecosystem Restoration

Climate change is predicted to further fragment and shrink California's ecosystems. Appropriate corrective actions should be designed to protect and/or expand and reconnect them, minimizing these effects. As water managers in the region identify adaptation strategies for water and flood management, they should consider strategies that will also benefit ecosystems as follows.

1. Establish large biological reserve areas that connect or reconnect habitat patches.
2. Promote multidisciplinary approaches to water and flood management.
3. Expand financial incentives for farmers to grow and manage habitat.
4. Improve instream flow needs (CDM, 2011).

Improved and enhanced aquatic and riparian habitats can provide significant water resource benefits through promoting groundwater recharge, protecting and improving water quality, and contributing to flood protection.

Forest Management

Although the cities that comprise the East Stanislaus Region's RWMG do not have responsibility to manage the upland forested areas that drain to the Region, protection of those lands is important for ensuring high quality surface runoff supplies. Proper forest management would improve water quality, help reduce wildfires, and improve ecosystem and habitat within the Region.

Additional stream gages and precipitation stations upstream of the Region (as well as within the Region itself) could help establish and confirm climate trends and evaluate hydroclimatic and geologic conditions. Water quality and sediment monitoring stations would allow quantification of the effects of climate change as well as forest management activities on surface water quality (CDM, 2011).

Other Strategies

Additional conservation and demand reduction measures, such as crop idling, irrigated land retirement, and rainfed agriculture could be implemented as adaptive management strategies under this RMS. As previously noted, however, these strategies could have significant economic impacts on the region and would be implemented after all other strategies have been considered and/or implemented.

3.6.2 No Regret Strategies

No regret adaptation strategies are those that make sense for current day conditions and the existing water management context, while also helping regions adapt to climate change and anticipated future conditions. The following table presents the No Regrets adaptation strategies for the East Stanislaus Region. The region either is already implementing or planning to implement the following No Regret strategies.

Table 3-6: No Regret Strategies in the East Stanislaus Region

Resource Management Strategies	No Regrets Strategy
Agricultural Water Use Efficiency	✓
Urban Water Use Efficiency	✓
Conveyance-Delta	
Conveyance-Regional/Local	
System Reoperation	
Water Transfers/Sales	✓
Conjunctive Management and Groundwater Storage	✓
Recycled Municipal Water	✓
Surface Storage-Regional/Local	
Drinking Water Treatment and Distribution	✓
Groundwater Remediation/Aquifer Remediation	✓
Matching Quality to Use	✓
Pollution Prevention	✓
Salt and Salinity Management	
Urban Runoff Management	✓
Agricultural Lands Stewardship	✓
Economic Incentives	✓
Ecosystem Restoration	✓
Forest Management	
Land Use Planning and Management	✓
Recharge Area Protection	✓
Watershed Management	✓
Flood Risk Management	✓

3.6.3 Mitigation/GHG Reduction Strategies

The East Stanislaus Region recognizes the importance and value of mitigating climate change by reducing energy use and associated GHG emissions. Water distribution can require significant amounts of energy. In California, 19% of the state's electricity and 30% of its natural gas is used for water-related activities (DWR, 2010a). As the East Stanislaus Region solicits and prioritizes projects for inclusion in its IRWM Plan, it must consider GHG emissions from the projects and ways to potentially mitigate climate change.

As described in Section 3.2, increasing GHG concentrations in the Earth's atmosphere contribute to warming trends and climate change impacts. Because the water industry is a significant contributor to GHG emissions and the overall increasing concentrations in the atmosphere, reducing GHGs generated in the conveyance, treatment, and distribution of water and wastewater poses a significant opportunity to help to achieve the GHG emission goals set by AB32 and reduce GHG emissions generated by water management.

The variation in temperature and precipitation projections from different emissions scenarios illustrates the importance of implementing mitigation measures now to address climate impacts already taking place. GHG emission reductions must be achieved through cooperation at global, national and regional levels to prevent or mitigate continued climate change impacts later in the century. Major components of climate change mitigation strategies include:

1. Improve Energy Efficiency
2. Reduce Emissions
3. Carbon Sequestration

Almost all resource management strategies identified by the *2009 CWP Update* can potentially reduce GHG emissions and mitigate climate change impacts. A list of applicable mitigation strategies is included in Table 3-7.

GHG emissions and climate change mitigation was considered in the project prioritization methodology, described in Chapter 6 of this IRWMP. Project-related GHG emissions were evaluated on a qualitative basis, and the results used as a secondary sorting criteria in the project prioritization process. Chapter 6 describes this process in more detail.

The following briefly summarizes how the applicable RMS could contribute to climate change mitigation in the East Stanislaus Region.

- Reduce Water Demand – implementing water use efficiency measures will help save water and energy by reducing the volume of water treated and distributed (pumped) throughout regional water systems.
- Improve Operational Efficiency and Transfers – optimizing water system operations will maximize efficiency and potentially reduce energy use. Reducing system losses will also reduce emissions by reducing the volume of water treated and distributed (pumped) throughout regional water systems.
- Increase Water Supply – depending on the method used to increase water supply (e.g. desalination versus increased storage), there may be a net increase or decrease in GHG emissions. Increasing storage could have GHG emissions associated with construction, but relatively low operational emissions.
- Improve Water Quality – GHG emissions depend on the specific project implemented to improve water quality. Matching quality to use generally has lower emissions than using

potable water for non-potable uses. Additionally, protecting water sources from future water quality degradation may offset the future need for water treatment.

- Improve Flood Management – where flood management encourages vegetation growth (e.g. ecosystem or floodplain restoration), carbon sequestration may help reduce net carbon emissions.
- Practice Resource Stewardship – implementing ecosystem restoration or forest management, for example, can contribute to carbon sequestration and potentially reduce net emissions.
- Other Strategies – some of the strategies included under this RMS could reduce GHG emissions by conserving water (i.e., crop idling, irrigated land retirement), whereas others may be more energy-intensive and increase emissions (i.e., dewvaporation, fog collection, and waterbag transport, which were not considered feasible RMSs for the East Stanislaus Region).

Table 3-7: Applicability of CWP Resource Management Strategies to GHG Mitigation

Resource Management Strategies	Greenhouse Gas Mitigation		
	Energy Efficiency	Emissions Reduction	Carbon Sequestration
Reduce Water Demand			
Agricultural Water Use Efficiency	✓	✓	
Urban Water Use Efficiency	✓	✓	
Improve Operational Efficiency and Transfers			
Conveyance-Regional/Local	✓	✓	
System Reoperation	✓	✓	
Water Transfers	*	*	
Increase Water Supply			
Conjunctive Management and Groundwater Storage	*	*	
Recycled Municipal Water	*	*	
Surface Storage-Regional/Local	*	✓	
Improve Water Quality			
Drinking Water Treatment and Distribution	✓	✓	
Groundwater Remediation/Aquifer Remediation	*	*	
Matching Quality to Use	*	*	
Pollution Prevention		✓	
Salt and Salinity Management		✓	
Urban Runoff Management	✓	✓	
Improve Flood Management			
Flood Risk Management			✓
Practice Resource Stewardship			
Agricultural Lands Stewardship			✓
Economic Incentives	✓	✓	✓
Ecosystem Restoration			✓
Forest Management			✓
Land Use Planning and Management	✓	✓	✓
Recharge Area Protection			✓
Water-dependent Recreation		✓	
Watershed Management	✓	✓	✓
Other Strategies			
Crop Idling for Water Transfers	✓	✓	
Irrigated Land Retirement	✓	✓	
Rainfed Agriculture	✓	✓	✓

Source: modified from CDM 2011
Key:
✓ indicates that in general this will provide a beneficial effect
X indicates that in general this will provide an adverse effect
* indicates that this may provide beneficial or adverse effects

3.7 Plan for Further Data Gathering

Identifying and implementing appropriate adaptation strategies requires data necessary to (1) understand the magnitude of climate change impacts and associated vulnerabilities, and (2) plan for strategy implementation in a timely manner. To aid in this understanding, the East Stanislaus Region has developed a data gathering and analysis approach to collect and assimilate data related to the prioritized climate changed vulnerabilities and to facilitate future water resource management. A preliminary data collection plan is summarized in the table on the following pages.

The preliminary data collection plan presented below represents a high-level overview of the types of data that may be collected, possible methods and frequency for data collection, and recommended responsible monitoring entities. In determining a final approach to data collection, the ESRWMP will need to determine how this preliminary plan aligns with existing monitoring programs and where new monitoring programs should be implemented. Additionally, as part of IRWM project implementation, numerous types of data will be collected to meet project performance and monitoring program requirements. These data will significantly contribute to the data collection described herein for further vulnerability assessment and will also need to be aligned with available resources and ongoing programs to minimize duplication of efforts.

Table 3-8: Preliminary Data Collection and Management Approach for Vulnerability Assessment

		Vulnerability Measurement Tools & Methods					
Vulnerability	**Vulnerability Indicators**	**Measure**	**Method**	**Frequency**	**Responsible Entity**	**Adaptation Goal(s)**	**Possible Near-Term Adaptation Actions**
Water Demand	Increased urban demand	Water meter data	Flow meters	Monthly	Water agencies	- Minimize urban demand - Sufficient storage to meet unexpected needs	Participate in community planning and regional collaborations relating to climate change adaptation Develop programs to encourage installation of advanced irrigation equipment Develop water conservation and demand management programs through water metering and rebate programs Demand management through public education on conservation Establish a relationship with local power utility and work jointly on strategies to reduce seasonal or peak water and energy demand
		Groundwater use reporting (unmetered systems)	Individual reporting to basin management authority	Annual	Basin management group		
		Evaluation of meter records	Electronic data compilation	Every five years	RWMG		
	Increased agricultural demand	Water meter data	Flow meters	Monthly	Water agencies & irrigation districts	- Minimize agricultural demand - Sufficient storage to meet unexpected needs	Participate in community planning and regional collaborations relating to climate change adaptation Reduce agricultural water demand by working with irrigators to install advanced irrigation equipment Develop water conservation and demand management programs through water metering and rebate programs Establish a relationship with local power utility and work jointly on strategies to reduce seasonal or peak water and energy demand Model agricultural water demand under future scenarios of climate change and projections of cropping types
		Groundwater use reporting (unmetered systems)	Individual reporting to basin management authority	Annual	Basin management group		
		Evaluation of meter records	Electronic data compilation	Every five years	RWMG		
	Increased CII demand	Water meter data	Flow meters	Monthly	Water agencies	- Minimize CII demand - Sufficient storage to meet unexpected needs	Participate in community planning and regional collaborations relating to climate change adaptation Demand management through public education on conservation Develop water conservation and demand management programs through water metering and rebate programs Work with power companies to evaluate feasibility of using recycled water or alternative cooling methods to meet power plant needs Optimize operations by restricting some energy-intensive activities during the summer to times of reduced electricity demand and work with energy utility on off-peak pricing
		Groundwater use reporting (unmetered systems)	Individual reporting to basin management authority	Annual	Basin management group		
		Evaluation of meter records	Electronic data compilation	Every five years	RWMG		

Vulnerability	Vulnerability Indicators	Vulnerability Measurement Tools & Methods: Measure	Method	Frequency	Responsible Entity	Adaptation Goal(s)	Possible Near-Term Adaptation Actions
	Increased demand for firefighting (wild and other)	Public records compared with meter records; statistical analyses	Electronic data compilation	Every five years	RWMG	- Minimize likelihood of wildfires through land management - Plan and managed supplies to meet firefighting needs	Use fire models and develop fire management plans for water supply sources in fire-prone watersheds Practice fire management plans in watersheds
Water Supply and Quality	More frequent droughts	Historical data tracking with statistical analyses	Electronic data compilation	Every five years	RWMG	- Minimize urban, agricultural and CII demands - Sufficient storage to cover drought periods	Conduct climate change impacts and adaptation training for staff Participate in community planning and regional collaborations relating to climate change adaptation Expand current resources through developing regional water connections for sharing during shortages
	Reduced surface water availability	Streamflow measurements	Stream gages or weirs	Continuously	California Department of Water Resources (CDEC), U.S. Geological Survey, water agencies, irrigation districts	- Minimize urban, agricultural and CII demands - Sufficient storage to cover drought periods	Use hydrologic models to project runoff and incorporate model results in water supply planning Diversify water portfolio to include drought-proof supplies like recycled water Practice conjunctive use and construct or expand infrastructure to support such use Construct infrastructure for additional surface and/or ground water storage (i.e. recharge facilities) Increase water storage capacity (i.e. silt removal from reservoirs) Retrofit intakes to accommodate lower water levels in reservoir and decreased late season flow
		Water stage at dam sites	Water level gages	Continuously	Irrigation districts		
	Increased groundwater salinity	Groundwater samples (Specific Conductance, Total Dissolved Solids)	Laboratory and in-field analyses	As needed – quarterly, annually, or every few years	Water agencies, groundwater management organizations	- Track and mitigate groundwater quality impacts through basin management activities	Simulate climate change scenarios/projections in groundwater models
	Increased groundwater overdraft	Groundwater elevations	Elevation monitoring data	Monthly or Seasonally	Water agencies, groundwater management organizations	- Track and mitigate groundwater overdraft through basin management activities	Simulate climate change scenarios/projections in groundwater models Diversify water portfolio to include drought-proof supplies like recycled water Practice conjunctive use and construct or expand infrastructure to support such use Construct infrastructure for additional surface and/or ground water storage (i.e. recharge facilities) Promote the use of LID techniques to encourage infiltration on the local level

		Vulnerability Measurement Tools & Methods					
Vulnerability	**Vulnerability Indicators**	**Measure**	**Method**	**Frequency**	**Responsible Entity**	**Adaptation Goal(s)**	**Possible Near-Term Adaptation Actions**
	Decreased surface water quality	Water quality parameters such as dissolved oxygen, total suspended solids, etc.	Laboratory and in-field analyses	Seasonally	Water agencies, resource conservation districts, volunteers	- Track and mitigate surface water quality impacts through watershed management activities	Manage reservoir water quality by investing in practices such as lake aeration Monitor surface water conditions, including water quality in receiving bodies Implement watershed practices to limit pollutant runoff to surface water Increase capacity for wastewater and storm water collection, treatment and discharge
		Ability of surface water treatment plants to treat diverted water	Number of violations	Annual	California Department of Public Health	- Maintain ability to treat surface water to drinking water standards	Develop models to understand potential water quality changes and costs of resultant changes in treatment Increase or modify treatment capabilities to address treatment needs of marginal water quality Implement or retrofit source control measures at treatment plants to deal with altered influent flow and quality
	Increased cost of imported supplies (indicator of regional and statewide demand)	Average market value of one acre-foot of water	Market survey	Periodic, as needed	RWMG, water agencies, irrigation districts	- Minimize the need for imported water	
Flood Management	Increased frequency of high flow events / shift in timing of snowmelt	Streamflow measurements	Stream gage	Continuously	California Department of Water Resources (CDEC)	- Plan for sufficient flood storage space under a variety of hydrologic conditions	Increase water storage capacity (i.e. silt removal from reservoirs) Develop plans for reoperation of reservoirs Monitor flood events and drivers that may impact flood and water quality models Set aside land for future flood-proofing needs (e.g. berms, dikes) Use land use planning to limit development in the flood plain Implement or retrofit source control measures that address altered influent flow and quality at treatment plants Build flood barriers, flood control dams, levees and related structures Increase channel capacity along lower river stretches to eliminate constrictions and enable higher flows

Vulnerability	Vulnerability Indicators	Vulnerability Measurement Tools & Methods: Measure	Method	Frequency	Responsible Entity	Adaptation Goal(s)	Possible Near-Term Adaptation Actions
	Increased areas of inundation	Area flooded during storm events	Insurance reports	Annual	California Department of Insurance	- Plan for and minimize potential flood-related damage	Participate in community planning and regional collaborations relating to climate change adaptation Develop and implement emergency response plans to deal with natural disasters Implement strategies on site and in municipalities to reduce runoff and associated pollutant loads into waterways Integrate flood management and modeling into land use planning Conduct extreme precipitation events analysis with climate change to understand the risk of impacts to water and wastewater infrastructure Plan for alternative power supplies to support operations in case of loss of power Establish mutual aid agreements with neighboring utilities Identify and protect vulnerable facilities Use land use planning and zoning to limit development in flood plains Integrate climate change risks, including flooding, into CIPs to build facility resilience against current and potential future risks Implement policies and procedures for post-flood repairs Monitor and inspect the integrity of existing infrastructure Set aside land for future flood-proofing needs (e.g. berms, dikes) Implement or retrofit source control measures that address altered influent flow and quality at treatment plants Build flood barriers, flood control dams, levees and related structures Relocate facilities to higher ground Study response of nearby wetlands to storm surge events
Ecosystem and Habitat	Impacted fisheries and other habitats	Fish count	Field studies	Seasonally	California Department of Fish and Game	- Track and mitigate fisheries impacts through watershed management activities	Monitor vegetation changes in watersheds
	Degradation of surface water quality	Water quality parameters such as dissolved oxygen, total suspended solids, etc.	Laboratory and in-field analyses	Seasonally	Water agencies, resource conservation districts, volunteers	- Track and mitigate surface water quality impacts through watershed management activities	Develop models to understand potential water quality changes Monitor surface water conditions, including water quality in receiving bodies Implement watershed practices to limit pollutant runoff to surface water

Vulnerability	Vulnerability Indicators	Vulnerability Measurement Tools & Methods				Adaptation Goal(s)	Possible Near-Term Adaptation Actions
		Measure	Method	Frequency	Responsible Entity		
	Increased water temperatures	Water temperature	Thermometer	Monthly	Water agencies, resource conservation districts, volunteers	- Track and mitigate surface water quality impacts through watershed management activities	Develop models to understand potential water quality changes Monitor surface water conditions, including water quality in receiving bodies
Hydropower	Decrease in power generation	Number of kilowatt hours produced	Data generation records	Annual	Modesto Irrigation District; Turlock Irrigation District Pacific Gas and Electric Company California Public Utilities Commission	- Reduce energy demand - Maximize hydroelectric generation	Develop plans for changing reservoir and hydropower operations Work with power companies to coordinate energy conservation programs (such as rebate programs) Establish a relationship with local power utility and work jointly on strategies to reduce seasonal or peak water and energy demand Work with power companies to evaluate feasibility of using recycled water or alternative cooling methods to meet power plant needs Optimize operations by restricting some energy-intensive activities during the summer to times of reduced electricity demand and work with energy utility on off-peak pricing
	Increase in power demands	Number of kilowatt hours delivered	Data transmission and metering records	Monthly	Modesto Irrigation District; Turlock Irrigation District Pacific Gas and Electric Company California Public Utilities Commission	- Reduce energy demand	
Other	Increased frequency of wildfires	Historical data tracking with statistical analysis	Electronic data compilation	Annual	California Department of Forestry and Fire Protection	- Land management to minimize wildfire	Monitor current weather conditions Use fire models and develop fire management plans for water supply sources in fire-prone watersheds Practice fire management plans in watersheds
	Reduced snowpack	Snowpack survey (depth of snowpack)	Snowpack measurements (depth and water content)	Seasonal	California Department of Water Resources	- Sufficient surface and/or ground water storage to replace lost snowpack storage	Monitoring current weather and hydrologic conditions Use hydrologic models to project snowpack and runoff, and incorporate results into planning

Chapter 4 ESIRWM Governance, Coordination and Outreach

4.1 Governance

The Governance Structure described in this document provides the basis for relationships within and procedures for governance of the East Stanislaus Integrated Regional Water Management (ESIRWM) planning region. The governance structure helps facilitate sustained regional water management and the associated IRWM processes, both now and into the future. The East Stanislaus IRWM region is inclusive and utilizes a collaborative, multi-stakeholder process that provides mechanisms to address water management issues and develop integrated multi-benefit regional solutions that incorporate environmental stewardship to implement future IRWM plans. Regardless of a person's or entity's ability to contribute financially to the East Stanislaus IRWM planning process, the ESRWMP engages them through public outreach and stakeholder processes as described in Chapter 4.3, Public Forums of this Integrated Regional Water Management Plan (IRWMP).

The Governance section of the IRWM Plan must:

- Name the RWMG responsible for development and implementation of the IRWMP.
- Define how the RWMG meets the definition of CWC §10539.
- Include a list of the RWMG and project proponents who adopted the Plan.
- Describe the governance structure and how it ensures the Plan will be updated and implemented beyond State grant programs.

- *Proposition 84 & 1E IRWM Guidelines*, November 2012, Pages 18 to 19

4.1.1 Organization

The primary groups composing the East Stanislaus IRWM Region governance structure include the **East Stanislaus Regional Water Management Partnership (ESRWMP)**, the official Regional Water Management Group, plus the Steering Committee (SC), the Public Advisory Committee (PAC), and the general public. In the future, additional committees or sub-committees may be formed as the need arises.

Members of the ESRWMP are a mix of elected officials, board of director members, and other representatives from the four ESRWMP member agencies (Cities of Modesto, Hughson, Ceres, and Turlock). According to California Water Code (CWC) §10539, a Regional Water Management Group (RWMG) is a "group in which three or more local agencies, at least two of which have statutory authority over water supply or water management, as well as those other persons who may be necessary for the development and implementation of a plan that meets the requirements of CWC §10540 and §10541, participate by means of a joint powers agreement, Memorandum of Understanding (MOU), or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies." For the ESIRWM region, all four entities have statutory authority over water supply or management in their respective jurisdictions, and all ESRWMP members signed an MOU dated August 23, 2011 (included in Appendix A) which formally formed the ESRWMP. Additional members can be added to the ESRWMP with approval of existing members and signing of the MOU. One representative from each MOU signatory participates on the ESRWMP; each MOU signatory has also designated one alternate such that at every ESRWMP meeting, there will be a representative for each member. A list of the ESRWMP representatives and alternates for each City are shown in Table 4-1 and are detailed in Appendix B. A more detailed description of the ESRWMP is included in Chapter 4.1.2, RWMG Composition.

Table 4-1: ESRWMP Representatives and Alternates

City	Category	Name	Contact Info
City of Modesto	Representative	David Geer	dgeer@modestogov.com
	Alternate	Dave Cogdill	dcogdill@modestogov.com
City of Turlock	Representative	Forrest White	fjwhite@charter.net
	Alternate	Amy Bublak	abublak@yahoo.com
City of Ceres	Representative	Chris Vierra	chris.vierra@stantec.com
	Alternate	Bret Durossette	bret.durossette@ci.ceres.ca.us
City of Hughson	Representative	Jill Silva	jsilva@hughson.org
	Alternate	Matt Beekman	mattbeekman@usa.net

The ESIRWM region operates primarily on a consensus basis. The ESRWMP acts as the lead voice in the IRWMP development and implementation as there are multiple agencies, stakeholders, and members of the public involved in the process. The ESRWMP also acts as the ultimate decision maker in the rare case that the other supporting committees cannot come to a consensus. The ESRWMP facilitates communication, cooperation and education between member agencies; facilitates implementation of the IRWMP and overall planning process; provides oversight to both the Steering Committee and Public Advisory Committee; finalizes the prioritization methodologies based on Committees' input; approves the screening and ranking of submitted projects; and ultimately determines the methodology for inclusion of projects in grant applications. ESRWMP meetings are held, as needed, at the discretion of the group. Each member agency is represented on the ESIRWMP by one person and one alternate (generally someone from within the agency's management structure with decision-making authority). The ESRWMP meetings are open to the public, and the public may provide comment on agendized items.

The **Steering Committee (SC)** leads preparation and implementation of the IRWMP and future amendments and updates of the Plan (as described further in Chapter 7 of this plan), and generally manages the work. Representatives of the SC are generally those that are actively managing projects. Responsibilities of the SC include:

- Manage contracts, information/databases, reporting
- Manage the IRWM Plan development and implementation
- Provide guidance to consultants and manage contracts
- Manage budgets and schedule
- Coordinate with the Public Advisory Committee
- Present unresolved issues/work tasks to the Public Advisory Committee
- Coordinate and implement the public outreach process
- Manage the East Stanislaus IRWMP website
- Ensure meetings are announced and posted in advance
- Coordinate distribution and posting of materials
- Convey Public Advisory Committee's recommendations to the ESRWMP
- Manages and formally submits IRWM-related grant applications

The SC representatives report back to the ESRWMP representatives throughout the planning process to brief them regarding specifics for plan implementation and to gain approval for the Plan's content. Similar to the ESRWMP, each agency or organization participating on the SC is represented by one person and one alternate; current representatives are shown in Table 4-2. SC members may remain engaged in the East Stanislaus IRWM planning process for the length of their affiliation with their representative agency and as long as they remain active in their role (per the SC Roles and Responsibilities). Additional SC members may be added at any time, provided the existing SC members do not object and the proposed member agrees to follow the Roles and Responsibilities adopted by the SC (Appendix C). SC meetings are open to the general public and the SC directly engages the public as needed, such as when public input is solicited on project/planning deliverables. During the SC meetings, the public may provide comments on agendized and non-agendized items.

Table 4-2: Steering Committee Representatives and Alternates

City	Category	Name	Contact Info
City of Modesto	Representative	Jack Bond	npinhey@modestogov.com
	Alternate	Jim Alves	jalves@modestogov.com
City of Turlock	Representative	Dan Madden	dmadden@turlock.ca.us
	Alternate	Michael Cooke	mcooke@turlock.ca.us
City of Ceres	Representative	Mike Brinton	Michael.Brinton@ci.ceres.ca.us
	Alternate	Toby Wells	Toby.Wells@ci.ceres.ca.us
City of Hughson	Representative	Thom Clark	tclark@hughson.org
	Alternate	Dominique Spinale	dspinale@hughson.org

The **Public Advisory Committee (PAC)** is a stakeholder committee that provides input and recommendations to the ESRWMP and SC, and is comprised of governmental and non-governmental organizations (NGOs), environmental groups, community organizations, disadvantaged communities and other special interest groups and parties. The PAC is the first tier of decision making and provides recommendations for developing project prioritization methodologies to the SC, helps screen, integrate and rank projects, contributes to development of the methodology for inclusion of projects in grant applications, provides direct public communication and seeks public feedback and input, and conducts other actions as directed. Similar to the ESRWMP, each agency or organization participating on the PAC is represented by one person and one alternate. When multiple applications are received for a single organization, the SC works with that organization to identify a single representative and an alternate for each organization, thereby providing equal representation by all interested parties. PAC members may remain engaged in the East Stanislaus IRWM planning process for the length of their affiliation with their representative agency and as long as they remain active in their role (per the PAC Roles and Responsibilities).

Generally, anyone who wants to participate in the IRWM planning and implementation process can, at a minimum, participate in the PAC. An open call for applicants for the PAC was placed on March 16, 2011 and was followed up by direct participation solicitation by ESRWMP member agencies. Additional PAC members may be added at any time, provided the existing PAC members do not object and the proposed member agrees to follow the Roles and Responsibilities adopted by the PAC (Appendix D). Current members of the PAC are shown in Table 4-3.

Table 4-3: Public Advisory Committee Representatives and Alternates

Name	Affiliation	Contact Info
Garner Reynolds	City of Newman	greynolds@cityofnewman.com
Felipe Casas	DAC representative	felipec@selfhelpenterprises.org
Laura Jensen	The Nature Conservancy	Laura_Jensen@TNC.org
Mike Willett	Turlock citizen, City of Patterson Staff	MWillett@ci.patterson.ca.us
Patrick Koepele	Tuolumne River Trust	Patrick@tuolumne.org
Daniel Padilla	Ceres area citizen	dpadilla@cenvaleng.co padillaengineering@yahoo.com
Julie Rentner	River Partners	jrentner@riverpartners.org
Jason Preece	California Department of Water Resources	jpreece@water.ca.gov

PAC meetings are open to the general public, who may provide comment on any meeting item, whether it is included on the meeting agenda or not. In fact, the Region has a large group of interested stakeholders who are unable to commit to the PAC meeting schedule but who participate in the process in an external manner (see Chapter 4.2.1, below, regarding stakeholders). The members on the stakeholder list are interested parties that receive updates of the IRWM planning process via email and are encouraged to provide comments electronically on draft East Stanislaus IRWMP-related documents. Subcommittees to the PAC are formed, as necessary, to discuss specific water management activities/goals or to assume specific tasks as designated by the PAC. These subcommittees have the same procedures and policies as the PAC.

The governance structure for the ESIRWM region is organized as shown in Figure 4-1. In general, the PAC and SC work on plan development and implementation in a concurrent manner, with information passed between the two committees through key participant attendance at both and through participation on subcommittees. The PAC then conveys information to the ESRWMP through the SC for final decision, as needed. Members of the ESRWMP and SC can attend the PAC meetings as they wish. This structure helps to ensure the long-term implementation of the IRWM program by ensuring the continuing participation of members, clearly defining the anticipated roles and responsibilities of each participating member, and by allowing for modifications and adaptations to meet changing future conditions.

Governance-related Documents:

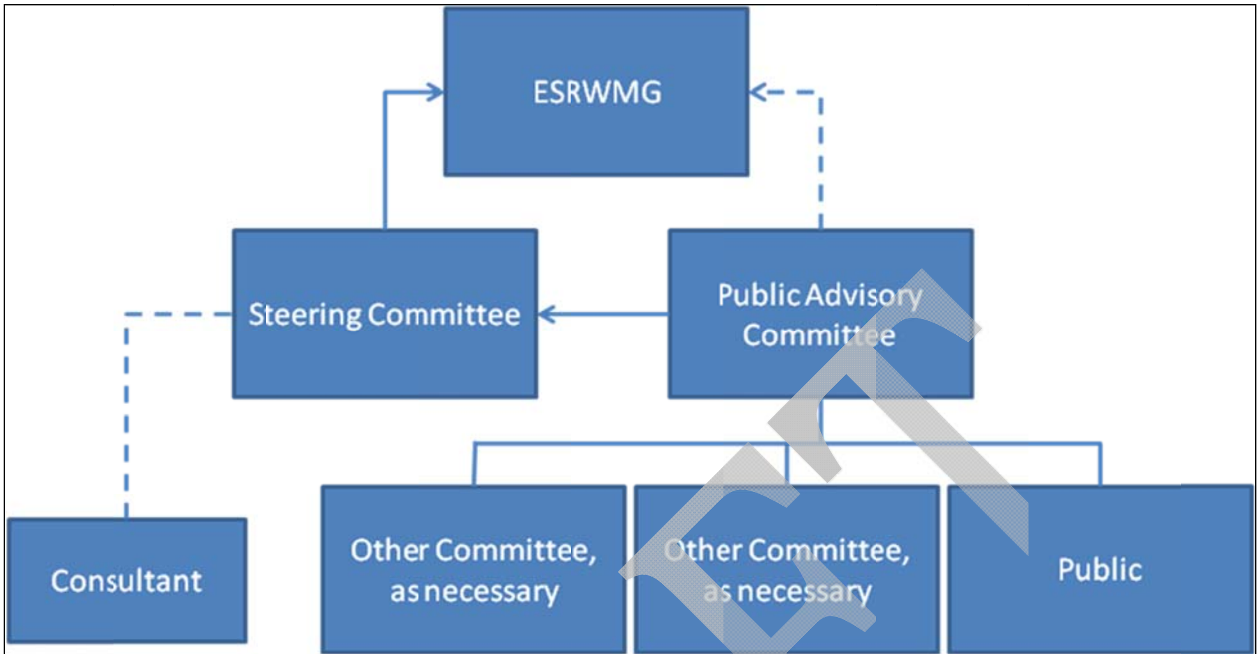
Appendix A – *East Stanislaus Regional Water Management Partnership MOU*

Appendix C – *Steering Committee Roles & Responsibilities*

Appendix D – *Public Advisory Committee Roles & Responsibilities*

Appendix E – *Outreach and Communications Plan*

Figure 4-1: East Stanislaus Region Governance Structure



Because the East Stanislaus Region is still relatively new, it is possible that new member organizations and/or forums may be added to the governance structure in the future as the Region matures. If an agency/entity/city would like to participate in some form of the Region's governance, the ESRWMP is first notified of their interest and the committee on which they would like to participate. The ESRWMP will then coordinate with the ESRWMP, SC and/or PAC members for consideration and acceptance. Organization representatives may be added to the ESRWMP, but signing the Region's MOU is a mandatory requirement. Additional members may also be added to the SC and/or PAC, however existing SC/PAC members must approve the addition and the new PAC members must represent organizations not current participating on the PAC. Signing the Region's MOU is not required for participation on the SC or PAC.

4.1.2 RWMG Composition

As previously noted, the official RWMG for the East Stanislaus IRWM Region is the East Stanislaus Regional Water Management Partnership (ESRWMP), currently comprised of four member agencies: the Cities of Modesto, Ceres, Turlock, and Hughson. This Region, and its associated RWMG, are relatively new and were recently developed, beginning in July 2010, to foster regional communication and cooperation and to cooperatively resolve potential water supply conflicts in the Region. Although there are other local agencies within the region that have statutory authority over water supply or water management and who have been invited to participate in the East Stanislaus IRWM planning process, some have shown interest while other agencies have chosen not to participate as part of the RWMG at this time or are still considering their level of participation. They will continue to be encouraged to participate in the PAC or within the general public forum, at a minimum and will be provided with meeting notices and other relevant information.

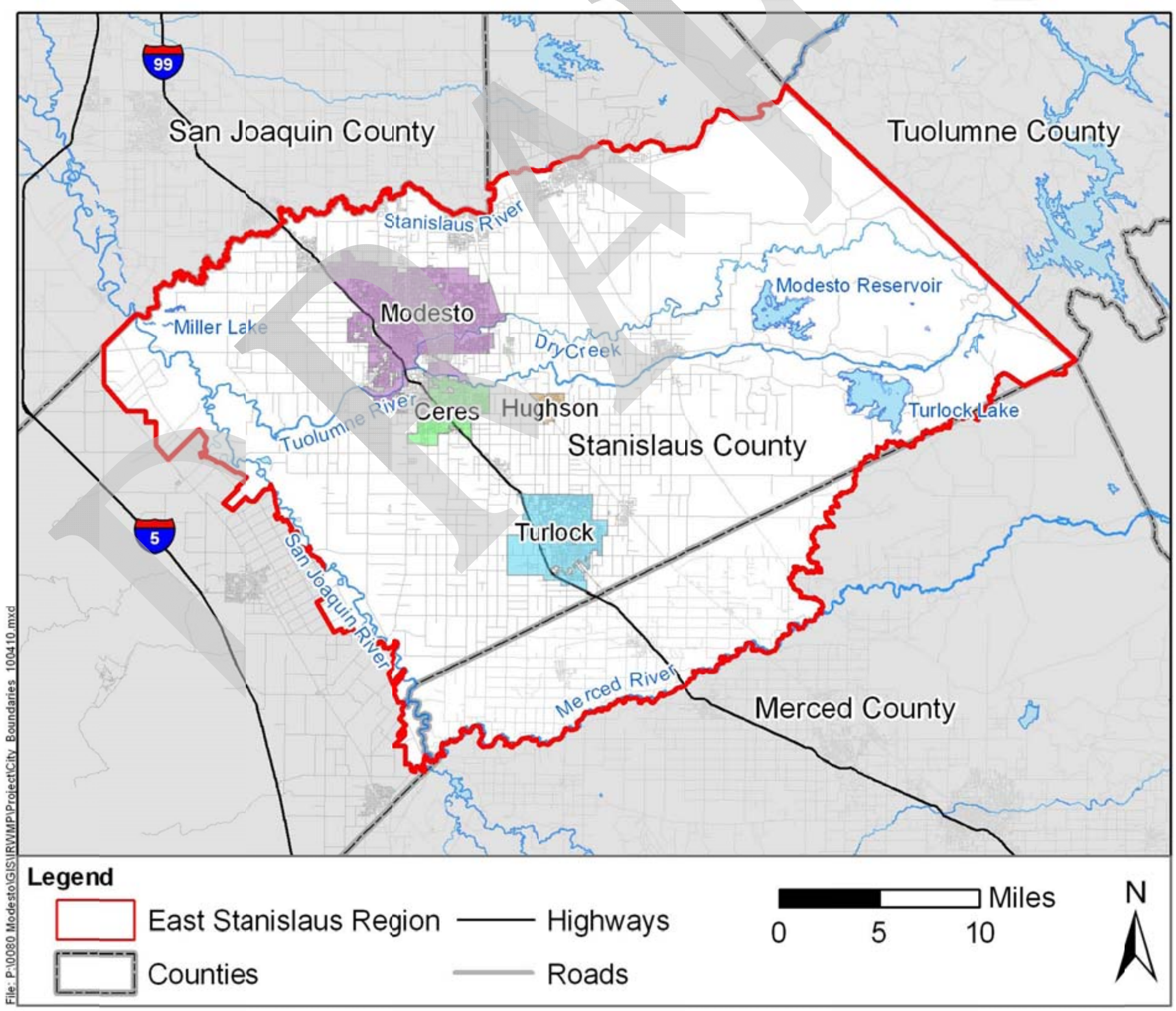
As it is currently structured, the RWMG member agencies cover various responsibilities within the Region. These are summarized in Table 4-4.

Table 4-4: Member Agencies' Water Management Responsibilities

Member Agency	Water Management Responsibility				
	Water Supply & Quality	Wastewater	Recycled Water	Stormwater/ Flood	Watershed/ Habitat
City of Modesto	✓	✓	✓	✓	✓
City of Ceres	✓	✓	✓	✓	✓
City of Turlock	✓	✓	✓	✓	✓
City of Hughson	✓	✓	✓	✓	✓

Each of the four cities is located within the East Stanislaus regional boundaries and manages multiple diverse aspects of water resources throughout the East Stanislaus Region. Further, each of the four cities is granted statutory authority to manage and deliver water within their purview under CWC Section 1460. The Cities' associated boundaries are shown in Figure 4-2.

Figure 4-2: ESRWMP Member Agencies



The City of Modesto provides drinking water, wastewater services, and storm drain and sewer maintenance to the city and surrounding communities. The City of Modesto supplies water to the City of Waterford and the communities of Salida, Empire, Hickman, Del Rio, Grayson, parts of the City of Turlock, a northern part of the City of Ceres, as well as other unincorporated County areas contiguous to the City of Modesto. Modesto pumps and delivers groundwater from 96 operating groundwater wells throughout its service area, and receives treated surface water through a long-term agreement with Modesto Irrigation District (MID) from Modesto Reservoir, which is operated by MID. Modesto also operates two wastewater treatment facilities; the Sutter Avenue Primary Treatment Plant and the Jennings Road Water Quality Control Plant, which was recently upgraded to provide tertiary treatment. There is potential for the City of Modesto to provide recycled water to users in the future; a feasibility study is currently underway by Del Puerto Irrigation District to further explore this option and identify new facilities that would be required for recycled water delivery and use. The Cities of Turlock and Ceres are also involved in this effort, referred to as the North Valley Regional Recycled Water Program (NVRRWP). Under the NVRRWP, up to 46,900 acre-feet per year of recycled water produced by the Cities of Modesto, Ceres, and Turlock would be delivered to Del Puerto Irrigation District and other potential users for agricultural irrigation.

Groundwater is the only source of potable water for the City of Ceres. The Ceres Water Services Division maintains the City's ten groundwater wells, two reservoirs providing a total of 4 million gallons (MG) of storage, and associated pipelines and pump stations. Ceres also manages storm drainage services to handle internal storm runoff and flood protection. The City of Ceres Sanitary Services Division manages, operates and maintains the Ceres Wastewater Treatment Plant and wastewater collection system. One million gallons per day (mgd) of wastewater from the City of Ceres is sent to and treated at the City of Turlock's Regional Water Quality Control Facility. Wastewater from Turlock's residents and commercial and industrial dischargers, as well as wastewater from Denair and Keyes Community Service Districts, is also treated at the Turlock Regional Water Quality Control Facility.

For water supplies, the City of Turlock relies solely on groundwater. Turlock serves a population of over 70,000 residents using 24 active groundwater wells and more than 230 miles of water distribution lines. The wells can produce a maximum of 53 million gallons of water per day. At present the Stanislaus Regional Water Authority, comprised of the Cities of Turlock, Modesto, and Ceres is developing the Regional Surface Water Supply Project. This project consists of a new Tuolumne River diversion, a 29 mgd water treatment plant and downstream transmission mains that would divert, treat, and deliver surface water supplied from TID to the Authority for treatment and use, providing a conjunctive use strategy and reducing reliance on groundwater sources. Turlock also provides recycled water for irrigation, and 2 mgd of recycled water is provided to TID for cooling purposes at its Walnut Energy Center. The Utility Maintenance Division of the City of Turlock provides safe and effective water, wastewater and storm distribution system and related services to its service area.

Similar to Ceres and Turlock, the City of Hughson manages the water, stormwater and wastewater systems within its city boundaries, relying solely on groundwater for its raw water. The City's water system consists of five groundwater wells scattered through the City, pumping from Turlock Groundwater Subbasin, and a distribution system with pipes ranging from 2- to 16-inches in diameter, as well as a storage tank with a capacity of 750,000 gallons.

As previously described in Section 4.1.1, Organization, the ESRWMP member agencies signed a MOU dated August 23, 2011 committing to the purpose of coordinating water resources planning efforts and developing an integrated regional water management plan (IRWMP) for the East Stanislaus Region. The MOU outlines the overall goals of the IRWM planning effort, the roles each city has as an ESRWMP member, as well as indicating that they are expected to adopt the completed

IRWMP. Any stakeholder entity that chooses to accept or adopt the East Stanislaus IRWMP will be asked to demonstrate support and commitment to implementation of the IRWMP once the plan is finalized.

4.1.3 Decision Making

Decisions within the East Stanislaus Region are made using a consensus-based approach. The East Stanislaus Region is still a relatively new IRWM region and thus far, only IRWM plan-related decisions have been made. The ESRWMP has developed a protocol for other decision-making processes as described herein.

Any decision being made by the ESRWMP is done so based on a vote; each member representative in the ESRWMP gets one vote and all actions require a simple majority vote. Regional decision-making and management processes may be revised as the Region matures and the IRWMP is developed and implemented. Methods to establish IRWMP goals and objectives, prioritize projects, implement the IRWMP, and revise and update the IRWMP in the future are discussed in other sections of this plan. Each is briefly summarized here:

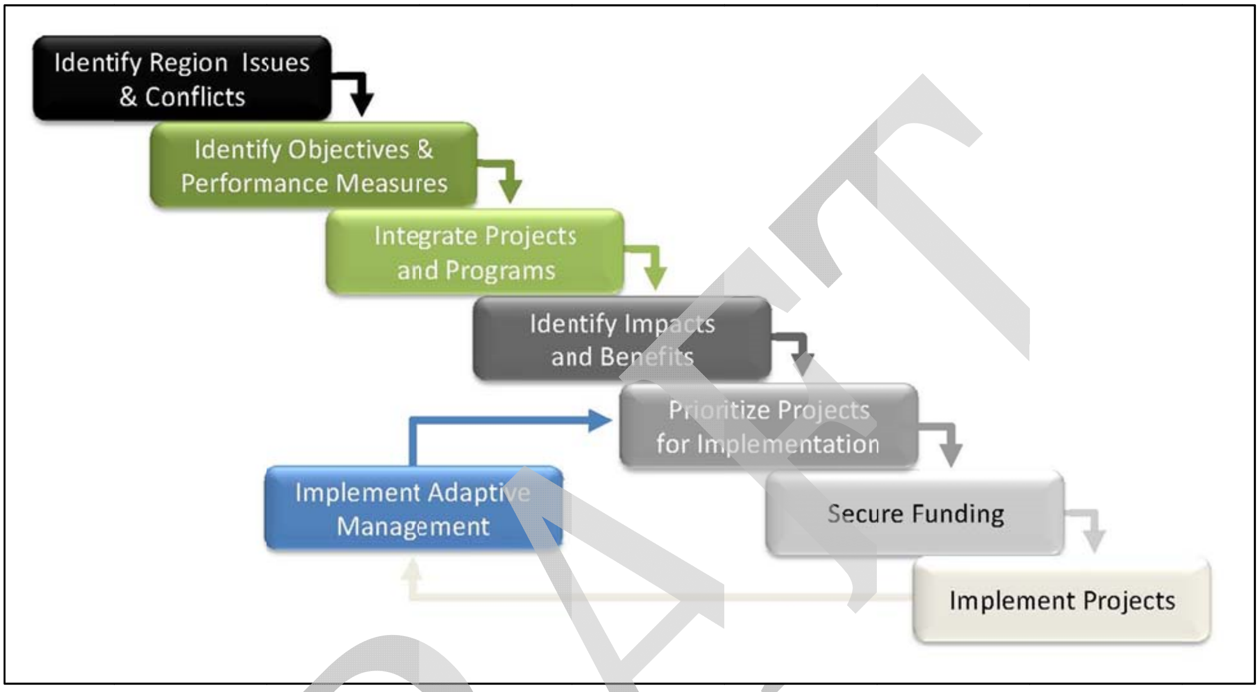
- **Establish IRWM Plan Goals & Objectives.** Issues and Conflicts within the East Stanislaus Region have been identified and were presented to DWR in East Stanislaus' Region Acceptance Process application. The SC and PAC jointly develop draft goals and objectives based on the identified Regional issues and conflicts; these are discussed in Chapter 4 of this IRWMP.
- **Prioritize Projects.** A prioritization process was developed for ranking submitted projects based on the degree to which they meet the IRWM Plan goals & objectives, in addition to any other parameters the ESRWMP and committees decide upon (e.g. IRWM Program Preferences). The process developed for this project prioritization is documented in Chapter 5 of this IRWMP.
- **Implement the IRWM Plan.** The SC will be the lead in ensuring the IRWM Plan is implemented. Based on the MOU signed by each ESRWMP member agency, it is the personnel and financial resources of each member that facilitated the development and implementation of this IRWM Plan. The IRWM Plan will be implemented through the implementation of a series of short-term projects and long-term projects and programs.
- **Revise and Update the IRWM plan.** The East Stanislaus IRWM Plan is a planning tool, and will require updates in response to emerging water management challenges and new project needs, and to ensure the Plan appropriately addresses the East Stanislaus Region's evolving needs. Similar to the implementation of the Plan, the SC will lead the effort to update and revise this Plan, as necessary, while the ESRWMP will provide the staff and financial support, as necessary to achieve this goal. This structure will help ensure the long-term sustainability of the East Stanislaus IRWM Plan and continual implementation of the Plan into the future. Chapter 7 of this document describes the process by which the East Stanislaus IRWMP is managed and updated.

As described above and shown in Figure 4-3 below, the East Stanislaus Region developed a specific, but flexible, method for decision making and a general framework for developing and implementing an IRWM Plan. The Region began by identifying specific goals and objectives to meet the identified water management issues and conflicts within the Region. These goals and objectives formed the basis for identifying and integrating the Plan's projects, prioritizing those projects, and completing an IRWM Plan.

All decisions required for preparation of the IRWMP, including development of the goals and objectives, identification, integration and prioritization of projects, and development of the IRWM

Plan, were completed in a collaborative manner. Initial decisions/initiative development were formulated at the SC and PAC level (in a collaborative manner), and were then brought to the ESRWMP for acceptance. The decision-making process and overall governance structure of the East Stanislaus Region thus facilitates the development of a single, collaborative water management portfolio prioritized based on meeting the regional goals and objectives.

Figure 4-3: ESRWMP Development Process



As described in Chapter 4 of this IRWMP, conflicts and issues within the Region were identified and discussed and agreed upon by the ESRWMP, SC and PAC. These regional conflicts and issues include:

- Water supply reliability for both agricultural and urban users;
- Localized flooding and stormwater quality issues;
- Groundwater overdraft and contamination; and
- Management and protection of surface water resources as both water supplies and recreation.

In the past, the cities and agencies in the area have worked together to develop solutions to the issues facing the Region. For example, recent studies have shown the Turlock Groundwater Basin may be overdrafted requiring even closer collaboration and planning for the Basin. The Turlock Groundwater Basin Association (TGBA) member agencies, including Turlock Irrigation District, Merced Irrigation District, the Cities of Ceres, Turlock, Modesto and Hughson, Hilmar and Delhi County Water Districts, the community services districts of Keyes, Denair, and Ballico, the Eastside and Ballico-Cortez Water Districts, and the Counties of Merced and Stanislaus, have been coordinating on issues related to the groundwater basin since the mid-1990's. Through this early coordination and identification of the overdraft conditions, the TGBA has conducted additional studies, updated the GWMP, and has developed projects to aid the recovery of the groundwater basin. The agencies involved in the East Stanislaus IRWM region have a history of successfully working together, and this is reflected in the way the ESRWMP operates. By forming the ESRWMP on a voluntary basis, building commitment through development of shared goals and objectives, the East Stanislaus IRWM effort will be sustained through the ongoing efforts to meet those goals and objectives.

In addition to the ESRWMP and its committees, general stakeholders, disadvantaged and tribal communities, the public at large, and adjacent IRWM regions also have a role in the East Stanislaus IRWM planning process. The Region has established an outreach process by which many of these stakeholders have been, and will continue to be, contacted, and their concerns and ideas solicited and considered for inclusion in this plan. This process is described in Chapter 4.2 of this IRWMP. Further, the ESRWMP has already begun coordinating with several adjacent IRWM regions to facilitate coordination of solutions to inter-regional issues and to advance inter-regional projects. For example, ESRWMP members are participating in meetings of the adjacent Westside-San Joaquin Region. The ESRWMP has also engaged in discussions with the Merced Region and the Tuolumne-Stanislaus Region on development of Letters of Cooperation with these regions. However, because the East Stanislaus Region is relatively new, relationships with other IRWM regions have not yet been formed. For its part, the ESRWMP will ensure the neighboring IRWM regions are invited to participate in its planning process and will endeavor to identify inter-regional projects and programs that can maximize benefits and beneficiaries for all regions involved. The East Stanislaus Region will strive to be inclusive rather than exclusive, not only within the Region but with neighboring IRWM Regions as the ESRWMP recognizes the effectiveness of developing integrated projects and programs to create multi-benefit opportunities.

4.2 Stakeholder Involvement and Outreach

An IRWMP must contain:

- A public process to provide outreach and opportunities to participate in IRWMP development and implementation to appropriate local agencies / stakeholders.
- A process used to identify, inform, invite and involve stakeholder groups in the planning process including mechanisms and processes to facilitate stakeholder involvement and communication during IRWMP development / implementation.
- A description of how the RWMG will endeavor to involve DACs and Native American tribal communities.
- A description of the decision making process including IRWM committees, roles, or positions that stakeholders can occupy and how a stakeholder can participate without contributing financially.
- A description of how stakeholders are necessary to address objectives and RMS of the IRWMP and how they are involved.
- A discussion of collaborative process that engage a balance of interest groups regardless of their ability to contribute financially.

- *Proposition 84 & 1E IRWM Guidelines*, November 2012, Pages 22 and 23

The East Stanislaus Region understands the importance of engaging stakeholders and the general public throughout the water management planning and IRWM process. In October 2011, the SC finalized a Stakeholder Outreach and Communications Plan to specify the identified methodology and approach to ensure the timely dissemination of information associated with preparation and implementation of the East Stanislaus IRWMP to the general public and stakeholders. The Outreach Plan includes identification of goals and objectives specific to public outreach, discussion of targeted outreach to disadvantaged communities (DACs), and methods for inter-regional coordination. The Outreach Plan is included as Appendix E. In order to engage stakeholders, including disadvantaged and tribal communities, the East Stanislaus Region conducts various meetings that are open to the public. DACs were identified through a Geographic Information System (GIS) analysis as discussed in Chapter 2. No tribal communities have been identified within the Region to date; however, it is possible that as more public meetings are conducted and additional outreach to stakeholders takes place, that tribal communities within the Region may be identified.

The SC provides notice of all meeting types by posting the agenda, notices, and minutes on the East Stanislaus IRWM planning website, as well as posting on a public announcement board and direct mailings and/or emails to members on the stakeholder contact list. The SC ensures all meeting notices are posted with ample time for the public to participate. Additionally, the SC has issued notices in local newspapers. For example, a public notice (in English) announcing the first public workshop in March 2011 was featured in the Turlock Journal, Modesto Bee, Ceres Courier. The same notice, but in Spanish, was published in the Vida en el Valle, a newspaper focused on the Latino community of the central San Joaquin Valley that is published weekly in five cities, including Modesto. The notices were also printed and placed in local libraries and city offices. Other notices published in newspapers were to announce the Notice of Intent to prepare the IRWMP. Copies of these notices and publications are included in Appendix F.

The governance structure developed for the East Stanislaus Region allows for the flow of information between committees and groups in the region. As with any agency or organization, there are overlaps and methods for communicating from the staff level to management level and above. The ESRWMP tends to be comprised of management level staff at the Cities of Modesto, Turlock, Ceres and Hughson; the SC includes staff level members from the cities; and the PAC is made of volunteering stakeholders from other cities and agencies. The governance structure is set-up so that members of the SC can attend PAC meetings and relay information to members of the ESRWMP regarding information and communication from the SC and PAC. Members of the SC often attend PAC meetings. Additionally, PAC members and general public can attend open ESRWMP meetings to provide comments and actively participate in development and implementation of the East Stanislaus IRWM Plan.

4.2.1 Stakeholders

On March 16, 2011, the ESRWMP conducted an initial public workshop to announce the creation of the East Stanislaus Region and the IRWM planning process within the Region. At this meeting, contact information of all meeting attendees was compiled and a stakeholder list was created. The stakeholder contact list is continually updated as new persons, entities, and organizations express interest in the IRWM planning process. The most recent version of this stakeholder list is included in Appendix G. Materials from the meeting including the PowerPoint presentation, handouts, and sign-in sheets are included in Appendix H.

In addition to providing general information about the IRWM planning process at the initial public meeting, a call for applications for participation in the Public Advisory Committee (PAC) was conducted in which stakeholders who wanted to become a member of the PAC could voice their interest in doing so, understanding that they will attend regularly scheduled meetings and are committing to a designated person or alternate in attendance. The PAC serves as one venue for conveying stakeholders input, comments, interests and ideas to the planning process. Unfortunately, no one signed up for the PAC at the March 16th initial public meeting, so a direct solicitation for participants followed and the initial PAC members were identified. As previously noted, it is anticipated that membership in the PAC will continue to expand as interest in the IRWMP grows. In the interim, direct outreach to the public and local agencies and organizations is continuing to encourage stakeholders to participate in the PAC.

Several other public meetings and workshops have been held subsequent to the March 2011 public meeting. These workshops were held at key junctures in the IRWMP development process and were held as follows:

- April 12, 2012 - public workshop to announce the call for (solicitation of) projects for inclusion in the IRWMP.
- [ADD MEETING DATE IN 2013] – public workshop to present the draft IRWMP and its contents.
- [ADD MEETING DATES IN 2013] – public meetings in conjunction with the IRWMP adoption by [ADD NAMES OF ADOPTING ORGANIZATIONS].

The public outreach process for the East Stanislaus Region provides stakeholders with two general options for involvement: (1) general public participation at the ESRWMP, Steering Committee, and PAC meetings and public meetings, and (2) involvement through participation in the PAC. This format ensures both a balanced and diverse collection of stakeholders due to the flexibility in the level of commitment and involvement for those interested.

The following methods are used to not only disseminate information to stakeholders, disadvantaged and tribal communities and the general public, but also can be used by them to provide input, ask questions, and participate in the planning process and IRWM Plan development process:

- ESRWMP, Steering Committee, and PAC meetings
- Public meetings
- East Stanislaus IRWM planning website
- Handouts, newsletters, advertisements

The East Stanislaus IRWM website allows for an even and effective exchange of information between the ESRWMP, regional stakeholders and the public, while the newsletters and handouts ensures information access for all. The ESRWMP recognizes the significance of stakeholder input and therefore provides these various avenues for participation. Public input is further described in greater detail in Chapter 4.3, Public Forums.

As previously noted, there are other local agencies within the Region with statutory authority over water supply and/or water management; these agencies have been invited to participate in the IRWM planning and implementation process, but some have declined at this time. Many of the local agencies have a history working with the member agencies; for example, the City of Modesto and the Modesto Irrigation District (MID) have a water supply relationship (wholesaler-retailer) and have prepared joint-Urban Water Management Plans (UWMPs) due to the overlap in water resources management and shared water resources. The ESRWMP cooperates with these other agencies and districts through various planning processes and implementation of projects, and will continue to do so into the future.

Other participants that will be involved in the IRWM planning and implementation process within the East Stanislaus Region are summarized in Table 4-5. Some of the stakeholders that are currently not participating have been contacted directly, and it is expected some will begin to participate as the IRWM process progresses. The Stakeholder Contact List (included in Appendix G) includes contact information for most of the identified stakeholders, and meeting updates, handouts, and announcements are mailed or sent electronically to these organizations to keep stakeholders informed and up to speed on ways to participate in the East Stanislaus IRWM process.

Table 4-5: Other Identified Participants in IRWM Planning Effort

Category	Participant Name	Working Relationship
Wastewater	Empire Sanitary District	Stakeholder (not currently participating)
	Salida Sanitary District	Stakeholder (not currently participating)
Irrigation / Water Districts	Modesto Irrigation District	Stakeholder (not currently participating)
	Turlock Irrigation District	Stakeholder (not currently participating)
	Eastside Water District	Stakeholder (not currently participating)
	Oakdale Irrigation District	Stakeholder (not currently participating)
	Merced Irrigation District	Stakeholder (not currently participating)
	Del Puerto Water District	Stakeholder (not currently participating)
	Ballico-Cortez Water District	Stakeholder (not currently participating)
	Delhi County Water District	Stakeholder (not currently participating)
	Hilmar County Water District	Stakeholder (not currently participating)
Cities	Riverbank	Stakeholder
	Patterson	Stakeholder
	Waterford	Stakeholder
	Oakdale	Stakeholder
Other Communities	Grayson	Stakeholder (not currently participating)
	Denair	Stakeholder (not currently participating)
	Del Rio	Stakeholder (not currently participating)
	Monterey Park Track	Stakeholder
Electrical Corporation	Pacific Gas & Electric	Stakeholder (not currently participating)
Counties	Merced	Stakeholder (not currently participating)
	Stanislaus	Stakeholder (not currently participating)
Federal, State and Local Agencies	Turlock State Park	Stakeholder (not currently participating)
	County Farm Bureau	Stakeholder
Disadvantaged Communities	Keyes	Stakeholder (not currently participating)
	Bret Harte	Stakeholder (not currently participating)
	Bystrom	Stakeholder (not currently participating)
	Hickman	Stakeholder (not currently participating)
	Shackleford	Stakeholder (not currently participating)
	Grayson	Stakeholder (not currently participating)
	Newman	Stakeholder
	West Modesto	Stakeholder (not currently participating)
	Empire	Stakeholder (not currently participating)
	Riverdale Park	Stakeholder (not currently participating)
	Friends of Tuolumne	Stakeholder (not currently participating)
Environmental Groups	Tuolumne River Trust	Stakeholder
	River Partners	Stakeholder

Note for Table 4-5: The ESRWMP has been, and will continue, contacting these stakeholder organizations directly to solicit participation in the East Stanislaus IRWMP.

4.3 Public Forums

The formation of the East Stanislaus RWMG and conception of the Region were announced to the public through a workshop on March 16, 2011. This workshop identified stakeholders and solicited for participants, agencies, and other entities that wanted to receive meeting announcements and updates. Contact information was collected, and an email distribution list was developed. This list continues to be updated with new additions as interest in involvement increases. Additional public involvement continues throughout the development of the East Stanislaus IRWMP and through implementation of the Plan, as described herein.

In order to make the public both aware of and a part of the regional water management planning and IRWM planning efforts within the Region, various methods have been applied to reach a varied audience. Public meetings have been conducted to introduce the IRWM process and, as needed, to update the public at key junctures in the regional water management process and to allow for public input. As discussed in the governance structure section, the ESRWMP conducts meetings for themselves, the Steering Committee, and the Public Advisory Committee. The public is allowed and encouraged to attend Steering Committee and Public Advisory Committee meetings and provide comments on both agendized and non-agendized items. The public is also welcome to attend open sessions of ESRWMP meetings to provide comments on agendized items only (similar to the way City Council meetings are conducted). The Steering Committee provides notice of all meeting types by posting the agenda, notices, and minutes on the East Stanislaus IRWM planning website (found at www.eaststanirwm.org), as well as posting on a public announcement boards and direct mailings to a mailing list of interested stakeholders. The Steering Committee ensures the meeting notices are posted with ample time for the public to participate in the meetings. Additionally, as documents are developed and public review is solicited, copies are placed in public libraries for public access and on the Region's website.

Other mechanisms used to ensure public awareness of the East Stanislaus IRWM process include the development and distribution of brochures, fact sheets and brief updates. Hard copies are available at meetings and electronic copies are sent to the email distribution list and posted on the Region's website. The website allows the ESRWMP to disseminate information to a wide audience. The website is updated on a bi-monthly basis, at a minimum, to maintain current meeting information and past project updates, press releases, meeting materials and other items of interest. The website domain is hosted by the City of Modesto, and each ESRWMP member agency has a link to the East Stanislaus IRWMP website on its respective agency-specific website. The website also allows for stakeholders to enter comments and questions, and provides contact information should they want to speak to an East Stanislaus Region representative. The website acts as a forum for the ESRWMP and stakeholders to exchange information throughout the IRWM planning process.

There are multiple ways for the public to gain access to the ESRWMP and IRWM process. The ESRWMP makes information available to the general public, including the status of the IRWM process and upcoming decisions to be made, through the handouts and website. If a member of the general public or a stakeholder has questions and comments, they are directed to a designated contact, Jim Alves at the City of Modesto (the designated ESIRWMP representative); his contact information is provided in Table 4-6.

Table 4-6: Contact Information

	City of Modesto
Point of Contact	Jim Alves
Title	Associate Civil Engineer
Mailing Address	1010 10th Street Modesto, CA 95354
Phone Number	209-571-5557
Fax Number	209-522-1780
Email Address	jalves@modesto.gov

The public can provide input to the ESRWMP by attending the meetings, calling the provided contact, or emailing the contact with comments and questions. The designated contact discusses the questions and comments received with the Steering Committee, who takes the public input into consideration and responds to each call or email, as appropriate. If the ESRWMP receives public comment directly, the group evaluates the issues raised, and provides the comments/input to the Steering Committee to consider and respond to as appropriate.

In order to address the diversity of water management issues, geographical representation and stakeholder interests within the East Stanislaus Region, the ESRWMP has identified, and directly invited, key parties to participate in meetings and committees. Additionally, the ESRWMP plans to partner with local colleges, such as Modesto Junior College, California State University-Stanislaus, Humphreys College, and San Joaquin Valley College to encourage participation from younger participants, between the ages of 18 and 25. There is also the potential to combine participation in meetings with classes and/or class projects and studies. By performing specific outreach to local colleges, a wide range of ideas and energy can be accessed.

4.3.1 Outreach to Disadvantaged Communities

A Disadvantaged Community (DAC), according to the State of California (CA Water Code, Section 79505.5(a)), is a community with a Median Household Income (MHI) less than 80 percent of the California statewide median household income. DWR compiled the U.S. Census Bureau's American Community Survey (ACS) data for the period of 2006 to 2010. Based on this data, a community with an MHI of $48,706 or less is considered a DAC. Within the East Stanislaus Region, the communities of Keyes, Bret Harte, Bystrom, Empire, Grayson, Shackelford, West Modesto, Riverdale Park, Newman, and portions of Modesto, Turlock, Denair, Hughson, Oakdale and Ceres are DACs. Involvement and participation by representatives of these communities during the East Stanislaus IRWM planning process was solicited and encouraged to help understand the issues confronted by DACs and better address the needs of minority and/or low-income communities. This outreach included discussions and meetings with representatives from the communities of Newman and Keyes. Objectives of specific outreach to DACs include:

- Solicit involvement by individual representatives from DACs within the East Stanislaus Region and encourage participation by those representatives as members of the PAC.
- For DACs which do not have designated community representatives on the PAC, encourage other PAC members to specifically advocate and represent the interests of those DACs which may lie within a PAC member's jurisdiction or area of special interest.
- Inform representatives and residents of DACs via flyers and newspaper notices about opportunities to get involved with the East Stanislaus IRWM planning process and participate in development, integration, and prioritization of projects.

4.3.2 Outreach to Native Americans

The City of Turlock acquired a list of Native American Contacts within Stanislaus County from the Native American Heritage Commission as part of the CEQA process for the Turlock Regional Water Quality Control Facility Upgrade and Expansion in 2009. The Native American contacts included a chairperson for the Tule River Indian Tribe, two Spiritual Leaders for the Southern Sierra Miwuk Nation, a Chairperson for the Southern Sierra Miwuk Nation, and a representative of the North Valley Yikuts Tribe. Based on the results of this assessment, there are no tribal communities within the East Stanislaus IRWM Region. Formal letter communications were conducted to two tribes with possible ties to areas within the Region, but no response has been received to date. Any Native American community member may, however, participate in the IRWM process through any of the stakeholder processes previously described. Continued efforts of various means will be used to locate and contact Native American interests within the Region through ongoing and future outreach efforts.

4.4 Coordination with Other/Neighboring IRWM Regions

The East Stanislaus IRWM Region borders the Eastern San Joaquin, Merced, Tuolumne-Stanislaus and Westside-San Joaquin IRWM Regions. The Region's boundaries were identified to fill the void in IRWM coverage in this part of California, as well as to balance the need for boundaries based on natural watershed, groundwater basins and political and jurisdictional boundaries. All known adjacent IRWM regions participated in either the 2009 or 2011 Region Acceptance Process and all have been approved. The regions adjacent to the East Stanislaus Region are described herein.

Eastern San Joaquin Region: The Eastern San Joaquin Region shares its southern border with the northern border of the East Stanislaus region. This border is marked by the Stanislaus River and the interface of the Modesto and East San Joaquin groundwater basins. There is no overlap between these two regions.

Merced Region: The Merced IRWM Region includes the eastern portion of the San Joaquin Valley within Merced County and was revised in the 2011 RAP process. The Merced Region defined its northern border as the Merced River watershed boundary while the East Stanislaus Region's southern boundary is defined as the Merced River, Turlock Irrigation District, and the Turlock groundwater basin. Due to the differences in boundary delineations, a slight overlap exists between the Merced Region and East Stanislaus Region. There is an understanding between the East Stanislaus and Merced Regions that cooperation and coordination may be required in the overlap area.

Tuolumne-Stanislaus Region: The Tuolumne-Stanislaus Region's western border is defined as the Tuolumne County line. The interface between the Tuolumne-Stanislaus and East Stanislaus

This Coordination Plan Standards includes:

- Identification of a process to coordinate water management projects and activities of participating local agencies & stakeholders to avoid conflicts and take advantage of efficiencies.
- Identification of other neighboring IRWM efforts and the way cooperation/ coordination will be accomplished.
- A discussion of any ongoing water management conflicts with adjacent IRWM efforts.
- Identification of areas where a State agency or other agencies may be able to assist in communication, cooperation or implementation of IRWMP components, processes, or projects, or where State or federal regulatory decisions are required before implementing the projects.

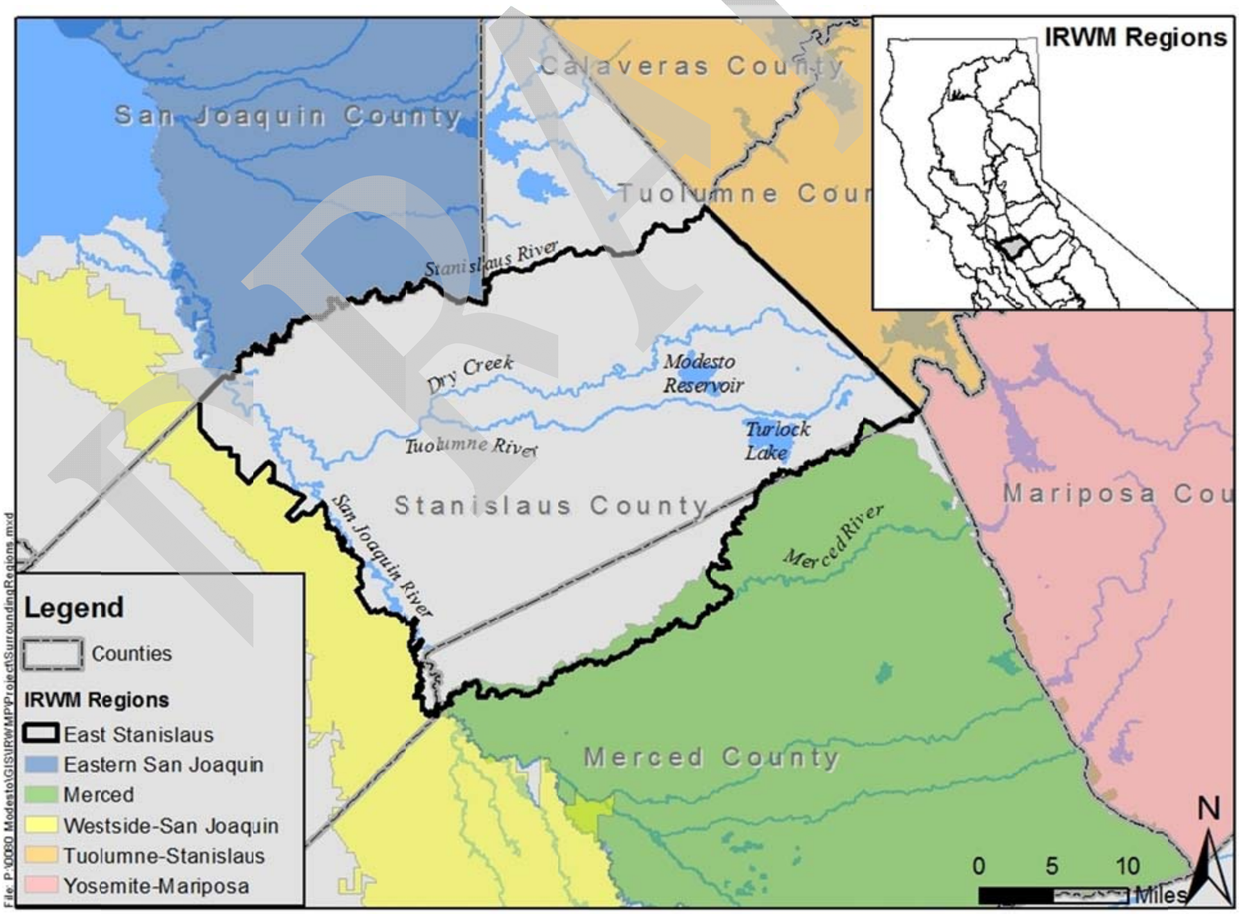
- *Proposition 84 & 1E IRWM Guidelines*, August 2010, Page 24

Regions is the border of Stanislaus and Tuolumne Counties. There is no overlap between these two regions.

Westside-San Joaquin: The Westside-San Joaquin Region's eastern boundary is adjacent to the East Stanislaus Region's western boundary. This boundary was defined by the Westside-San Joaquin Region using the San Joaquin River; however, the boundary does not strictly follow the river. The western boundary of the East Stanislaus Region simply follows the boundary as defined by the Westside-San Joaquin Region, such that there is no overlap.

As shown in Figure 4-4, the East Stanislaus Region shares borders with the Eastern San Joaquin Region, the Westside-San Joaquin Region, the Merced Region, and the Tuolumne-Stanislaus Region, and is adjacent to the Yosemite-Mariposa Region. When the East Stanislaus regional boundaries were being developed in 2010, the Yosemite-Mariposa Region (formerly the Central California Region) overlapped with the Merced Region and shared boundaries with the East Stanislaus Region. Because of the major overlap the Yosemite-Mariposa and Merced Regions were only conditionally approved by DWR. The Yosemite-Mariposa boundaries were modified during the 2010 RAP to eliminate its overlap with the Merced Region, while the Merced regional boundaries remained unchanged. The East Stanislaus therefore has a small overlap with the Merced Region, but avoids overlaps with all other surrounding IRWM regions.

Figure 4-4: Surrounding IRWM Regions



As previously noted, the East Stanislaus Region was developed to fill in the obvious void in IRWM coverage in the Central Valley. When determining the boundaries for the Region, however, natural water boundaries were also important so that the Region would make sense from a watershed perspective, given the region's use of surface water as part of its supply and distinct features. This criterion resulted in a triangular area in the north-eastern portion of Stanislaus County being left uncovered by the East Stanislaus Region. This area is not in the Modesto groundwater basin, which was used to determine the northern boundary, and its surface water drains into the East San Joaquin Region. This area overlies the Eastern San Joaquin groundwater basin, an area mostly covered by the Eastern San Joaquin IRWM Region. The East Stanislaus Region plans to discuss the triangular gap with the bordering Eastern San Joaquin Region and the Tuolumne-Stanislaus Region to ensure that stakeholders in that area are not neglected.

The East Stanislaus Region has begun coordinating with surrounding regions. The ESRWMP has an ongoing relationship with members of the Westside-San Joaquin IRWM Region in which members of the ESRWMP have attended meetings with the Westside-San Joaquin Region and participated in the planning process. The Tuolumne-Stanislaus and the East Stanislaus Regions have established an interim coordination and communication protocol. Because development of the East Stanislaus Region is relatively new, relationships with other IRWM regions are in initial stages or have not yet materialized. The ESRWMP plans to discuss water management strategies that have or will be employed by each of the neighboring IRWM Regions to identify opportunities for inter-regional collaboration and to optimize management strategies.

4.5 Coordination with State/Federal Agencies

The governance structure allows for any interested party to participate in the East Stanislaus IRWM planning process including members from State and federal agencies in the same manner as any other regional stakeholder. The other opportunity for the East Stanislaus Region to interface with State and federal agencies is through funding secured from State and federal agencies, as well as during permit acquisition for specific projects in the IRMWP and preparation of environmental documentation. If funding were secured from a State or federal agency to implement projects included in the IRWMP, on-going coordination would be required during project implementation and after. Similarly, projects that are implemented will require certain State and federal approvals including various permits and/or environmental approvals. Projects will be compliant with the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA), as necessary. Completion of CEQA/NEPA documentation would require coordination with various State and federal agencies.

At present, the East Stanislaus Region is coordinating indirectly with the Department of Water Resources. This coordination is occurring through both the IRWM process and through the Regional Flood Management program.

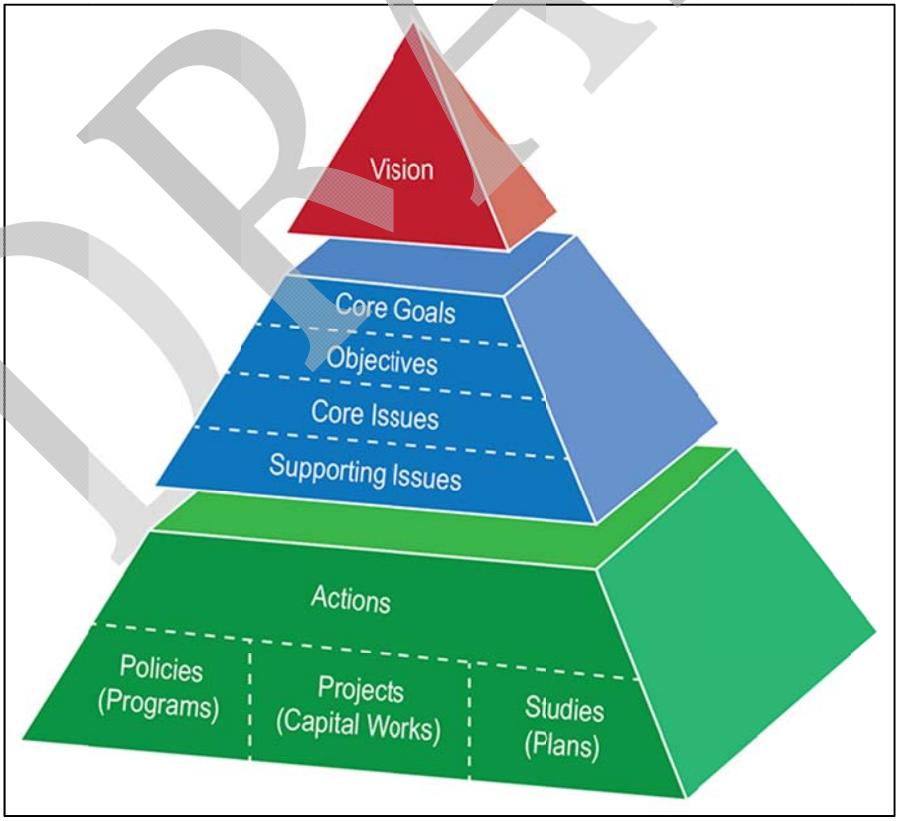
Chapter 5 Vision, Goals, and Objectives

> The IRWM Plan must clearly present plan objectives and describe the process used to develop the objectives. Plan objectives must address major water-related issues and conflicts within the region. In addition, objectives must be measureable by some practical means so achievement of objectives can be monitored.
>
> The objectives may be prioritized for the region. The IRWM Plan must contain an explanation of the prioritization or reason they the objectives were not prioritized.
>
> - *Proposition 84 & 1E IRWM Guidelines*, November 2012, Page 20

In order for the East Stanislaus Region to effectively manage its water resources, it first identified the regional water resources-related conflicts and issues to be resolved through this Integrated Regional Water Management Plan (IRWMP). The Region then developed a shared vision, outlining what the future of water management will look like for the region. Goals were then developed, defining what exactly the Region would like to achieve in meeting its vision. These goals are steps required to achieve the vision (Figure 5-1). Finally, objectives were defined for each goal. Each objective was framed to be specific, measureable and attainable and once achieved, will move the region forward towards achieving its goals, and ultimately, its vision. This IRWMP represents that pathway that the East Stanislaus Region will follow to achieve its objectives, goals and vision.

The identified conflicts, and goals and objectives to address the conflicts, as well as the process used, are discussed in this section.

Figure 5-1: Relationship between Vision, Goals, and Objectives



Regional Conflicts and Issues

Regional conflicts, as well as the goals and objectives described in Section 5.1, were brainstormed and discussed at several Steering Committee (SC) and Public Advisory Committee (PAC) meetings held between September 2011 through December 2011. Each committee revised an initial list of identified regional conflicts and issues; the list was finalized in January 2012. The primary water resources-related issues and conflicts identified within the East Stanislaus Region include:

- Water supply reliability
- Drinking water quality
- Water quality protection
- Groundwater overdraft, contamination, and recharge
- Protection and enhancement of aquatic, riparian, and watershed resources
- Water-related needs for disadvantaged communities
- Flood protection
- Recycled water use
- Water conservation
- Aging infrastructure

These shared conflicts and interests within the East Stanislaus Region led to cooperatively-developed regional goals and objectives.

5.1 Region's Vision for Water Resources Management

After reviewing the identified conflicts and issues, the East Stanislaus Regional Water Management Partnership (ESRWMP) established a vision for the Region to act as a guiding principal throughout the IRWM planning process and establish what future regional water management will achieve.

The East Stanislaus region's vision for IRWM planning is to:

> *Integrate projects to provide multiple benefits, resolve identified issues and conflicts, and meet the regional goals and objectives to achieve water reliability and sustainability and flood protection while protecting and enhancing the environment and regional economies and culture.*

5.2 Region Goals & Objectives

5.2.1 Goals and Objectives

Identifying the Region's issues and conflicts allowed the SC and PAC to develop goals that, if achieved, would help resolve the issues in the Region and achieve its vision. For example, the committees identified drinking water quality, water quality protection, and groundwater overdraft and contamination as issues in the region. To address these, a water quality-focused goal was developed – *Protect and improve water quality for beneficial uses consistent with regional interests and the Regional Water Quality Control Board (RWQCB) Basin Plan in cooperation with local, state, and federal agencies, and regional stakeholders.* Then, for the identified goal, a number of measureable objectives were developed that would enable the region to determine if the goal is being achieved. Goals were identified in the categories of Water Supply, Flood Protection, Water Quality, Environmental Protection and Enhancement, Regional Communication and Cooperation, and Economic and Social Responsibility.

Water Supply Goals and Objectives

Goal:

Protect existing water supplies and water rights, and improve regional water supply reliability.

Objectives:

- Provide a variety of water supply sources, including recycled water, to meet all current and future demands (urban, agricultural and the environment) under various hydrologic conditions.
- Promote the use of groundwater storage and conjunctive use options to reduce groundwater overdraft.
- Protect existing water rights.
- Implement water conservation plans for both urban and agricultural uses.
- Support monitoring and research to improve understanding of water supplies and needs.
- Address conveyance infrastructure needs.

Flood Protection Goals and Objectives

Goal:

Ensure flood protection strategies are developed and implemented through a collaborative process, utilizing both local and watershed-wide approaches designed to maximize opportunities for comprehensive water resource management.

Objectives:

- Develop outlines of regional projects and plans necessary to protect infrastructure from flooding and erosion from the 100-year event.
- Work with stakeholders to preserve existing flood attenuation by implementing land management strategies throughout the watershed.
- Develop approaches for adaptive management that minimize maintenance requirements and protect water quality and availability while preserving and enhancing ecologic and stream functions, as appropriate.
- Provide community benefits beyond flood protection, such as public access, open space, recreation, agricultural preservation, and economic development.
- Protect, restore, and enhance the natural ecological and hydrologic functions of rivers, creeks, streams and their floodplains.

Water Quality Goals and Objectives

Goal:

Protect and improve water quality for beneficial uses consistent with regional interests and the RWQCB Basin Plan in cooperation with local, state and federal agencies and regional stakeholders.

Objectives:

- Meet or exceed all applicable water quality regulatory standards.
- Deliver agricultural water to meet water quality guidelines established by stakeholders.

- Aid in meeting Total Maximum Daily Loads established, or to be established, for the Tuolumne River watershed.
- Protect surface waters and groundwater basins from contamination and threat of contamination.
- Manage existing land uses while preserving or enhancing environmental habitats.
- Minimize impacts from storm water through implementation of Best Management Practices, Low Impact Development or other similar projects.
- Promote programs and projects to reduce the quantity and improve the quality of urban and agricultural runoff.
- Promote and support regional monitoring to further understanding of water quality issues.

Environmental Protection and Enhancement Goals and Objectives

Goal:

Protect the environmental resources of the Stanislaus, Tuolumne, Merced and San Joaquin River watersheds by identifying, promoting and implementing opportunities to assess, restore and enhance natural resources of these watersheds.

Objectives:

- Identify and incorporate (where possible and reasonable) opportunities to assess, protect, enhance, and/or restore natural resources when developing water management strategies.
- Minimize adverse effects on biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological sites when implementing strategies and projects.
- Identify opportunities for open spaces, trails and parks along creeks and other recreational projects in the watershed to be incorporated with water supply, water quality, or flood protection projects.
- Contribute to the long-term sustainability of agricultural, commercial, industrial, and urban land uses and activities within the basin.
- Identify opportunities to protect, enhance, or restore habitat to support all watersheds in the Region in conjunction with water supply, water quality, or flood protection projects.
- Support projects to understand, protect, improve and restore the region’s ecological resources.

Regional Communication and Cooperation Goals and Objectives

Goal:

Implement and promote this IRWM Plan through regional communication, cooperation, and education.

Objectives:

- Develop a forum for consensus decision-making and IRWM Plan implementation by regional entities.
- Build relationships with State and Federal regulatory agencies and other water forums and agencies to facilitate permitting of water-related projects and ensure continued consistency with state water plans.
- Facilitate dialogues between regional and inter-regional entities to reduce inconsistencies and conflicts in water management and to maximize benefits from water-related projects.
- Maintain avenues of communication with the general public and offering opportunities to provide feedback on the IRWM and water-related projects through the regional websites and other public forums.
- Identify opportunities for public education about water supply, water quality, flood management, and environmental protection.

Economic and Social Responsibility Goals and Objectives

Goal:

Promote development and implementation of projects, programs and policies that are socially impartial and economically sound.

Objectives:

- Support the participation of disadvantaged communities in the development, implementation, monitoring and long-term maintenance of water resource projects.
- Develop cost-effective multi-benefit projects.
- Consider disproportionate community impacts to ensure environmental justice.
- Maximize economies of scale and governmental efficiencies.
- Protect cultural resources.
- Reduce energy use and/or use renewable resources where appropriate.

5.2.2 Prioritizing Objectives

The regional IRWM planning participants chose to prioritize the Region's goals, and therefore the associated objectives, for use in project prioritization. The planning participants felt that by prioritizing the Region's goals and objectives, along with the Statewide priorities and other relevant factors, that the resulting ranking of projects would help to identify those projects that, when implemented, would have the greatest impact in addressing the identified conflicts and issues and would best help the Region achieve its vision for regional water resource management. The participants chose to use a weighting schema to prioritize the projects, allowing for flexibility in future changes to the prioritized objectives as regional water resources issues change. Table 5-1 summarizes the measurements for each objective.

Table 5-1: Measures for Regional Goals and Objectives

Goal/Objective	Possible Measure(s)
Water Supply	
Provide a variety of water supply sources to meet all current and future demands under various hydrologic conditions	Acre-feet of water supply by water type; Percent demand met in any given year; Comparison of projected demand to existing water supplies
Promote the use of groundwater storage and conjunctive use options to reduce groundwater overdraft	Number of local conjunctive use programs; Acre-feet of water stored (directly and/or in-lieu); groundwater elevations
Protect existing water rights	Acre-feet of water delivered compared to perfected water rights
Implement water conservation plans for both urban and agricultural uses	Number of Demand Management Measures (DMMs) implemented regionally; Acre-feet of conserved water annually; 2015 and 2020 per capita water use rates
Support monitoring and research to improve understanding of water supplies and needs	Ongoing and new monitoring programs; Regional demand estimates
Address conveyance infrastructure needs	Acre-feet of water lost through leakage; Percent demand met
Flood Protection	
Develop outlines of regional projects and plans necessary to protect infrastructure from flooding and erosion from the 100-year event	Project list from Regional Flood Management Plan (RFMP); Incorporate RFMP project list into IRWMP project list
Work with stakeholders to preserve existing flood attenuation by implementing land management strategies throughout the watershed	Coordinate with Regional Flood Management Plan effort
Develop approaches for adaptive management that minimizes maintenance requirements and protects water quality and availability while preserving and enhancing ecologic and stream functions, as appropriate	Coordinate with Regional Flood Management Plan to ensure adaptive management element; Incorporate RFMP elements into IRWMP Update
Provide community benefits beyond flood protection, such as public access, open space and recreation	Number of multi-benefit projects identified and/or implemented providing flood protection and other benefits

Flood Protection (cont'd)	
Protect, restore, and enhance the natural ecological and hydrologic function of rivers, creeks, streams and their floodplains	Number of acres of riparian habitat/floodplain restored or protected
Water Quality	
Meet or exceed all applicable water quality regulatory standards	Basin Plan Water Quality Objectives (narrative and numerical); water quality
Deliver agricultural water to meet water quality guidelines established by stakeholders	Water quality monitoring data
Aid in meeting TMDLs established, or to be established, for the Tuolumne River watershed	Constituent concentrations (for specific TMDLs)
Protect surface waters and groundwater basins from contamination and threat of contamination	Surface and groundwater water quality monitoring data
Manage existing land uses while preserving or enhancing environmental habitats	Number of acres of habitat protected/maintained
Minimize impacts from storm water through implementation of BMPs, LID and other similar projects	Number of projects implemented incorporating storm water BMPs, LID or the like
Promote programs and projects to reduce the quantity and improve the quality of urban and agricultural runoff	Storm water monitoring data
Promote and support regional monitoring to further understanding of water quality issues	Participation in state and federal monitoring programs such as CASGEM; monitoring data
Environmental Protection and Enhancement	
Identify and incorporate (where possible and reasonable) opportunities to assess, protect, enhance, and/or restore natural resources when developing water management strategies	Number of acres of habitat restored, enhanced or protected
Minimize adverse effects of biological and cultural resources when implementing strategies and projects	Measurement and monitoring of biological and cultural resources before and after project development
Identify opportunities for open spaces, trails and parks, and other recreational projects to be incorporated with water supply, water quality or flood protection projects	Number of multi-benefit projects on IRWMP list that incorporate open space, trails, parks or other recreational benefits

Environmental Protection and Enhancement (cont'd)	
Contribute to the long-term sustainability of agricultural, commercial, industrial and urban land uses and activity in the basin	Number of acres of each land use type in the Region
Identify opportunities to protect, enhance, or restore habitat to support all watersheds in the Region in conjunction with water supply, water quality, or flood protection projects	Number of multi-benefit projects on IRWMP list that include the protection, enhancement, or restoration of watershed habitats
Support projects to understand, protect, improve and restore the region's ecological resources	Number of multi-benefit projects on IRWMP list that include the protection, improvement, or restoration of ecological resources
Regional Communication and Cooperation	
Develop a forum for consensus decision-making and IRWM Plan implementation by regional entities	Develop and implement governance structure that is based on consensus decision-making; Develop protocols for committee decision-making based on consensus
Build relationships with State and Federal regulatory agencies and other water forums and agencies to facilitate permitting of water-related projects and ensure continued consistency with state water plans	Invite State and Federal regulatory agency representatives to participate in IRWM regional governance; Participate in and/or coordinate with, either formally or informally, with State and Federal regulatory agencies and other water forums
Facilitate dialogues between regional and inter-regional entities to reduce inconsistencies in water management strategies and to maximize benefits from water-related projects	Communicate directly with adjacent IRWM regions; Participate in opportunities for dialogues with other IRWM regions
Maintain avenues of communication with the general public and offering opportunities to provide feedback on the IRWM and water-related projects through the regional websites and other public forums	Develop and maintain IRWM website; Provide notice of and conduct public workshops and meetings;
Identify opportunities for public education about water supply, water quality, flood management, and environmental protection	Number of multi-benefit projects on IRWMP list that include public education components

Economic and Social Responsibility	
Support the participation of disadvantaged communities (DACs) in the development, implementation, monitoring and long-term maintenance of water resource projects	Provide direct outreach to DACs; Provide contextual and technical support to DACs as funding permits
Develop cost-effective multi-benefit projects	Number of multi-benefit projects on IRWMP list; Evaluation of costs and benefits of projects on IRWMP list
Consider disproportionate community impacts to ensure environmental justice	Geographical distribution of projects on IRWMP list relative to DAC locations
Maximize economies of scale and governmental efficiencies	Number of projects on IRWMP list with multiple project proponents; Evaluation of costs and benefits of projects on IRWMP list
Protect cultural resources	Measurement and monitoring of cultural resources before and after project development
Reduce energy use and/or use renewable resources where appropriate	Number of projects on IRWMP that include energy-reduction or renewable energy components

During development of the project prioritization process, the SC and PAC applied weighting factors to the scoring criteria which included the categories of Regional Objectives, Statewide Priorities, Other Strategies, and Feasibility. With the Region's vision in mind, the Regional Objectives account for half of the total weight, as collectively, achieving the region's goals and objectives are at the forefront of successful IRWM planning. Of that, the goals were then weighted individually as shown below. The committees agreed that water supply, flood protection, and water quality are major issues that need to be addressed, as demonstrated by each category accounting for 10% of a project's score. Then, environmental protection and enhancement, and regional communication and cooperation each account for 7% of a project's score, and lastly, but still importantly, economic and social responsibility accounts for 6% of a project's score. The planning participants also felt that achieving the Statewide Priorities, addressing other project aspects (such as readiness to proceed) and project feasibility also merited consideration in project ranking, and assigned relative weights accordingly. The resulting percentages applied to the various project scoring criteria are summarized below. A sample project scoring sheet, also showing the assigned category weights, is included in Appendix K.

- Regional Objectives – 50%
  - Water Supply – 10%
  - Flood Protection – 10%
  - Water Quality – 10%
  - Environmental Protection and Enhancement Goal – 7%
  - Regional Communication and Cooperation – 7%
  - Economic and Social Responsibility – 6%
- Statewide Priorities – 25%
  - Drought Preparedness – 5%
  - Use and Reuse Water More Efficiently – 5%
  - Climate Change Response/Adaptation Actions –3%
  - Expand Environmental Stewardship – 2%
  - Practice Integrated Flood Management – 3%
  - Protect Surface Water and Groundwater Quality – 3%
  - Improve Tribal Water and Natural Resources – 2%
  - Ensure Equitable Distribution of Benefits; Provide Environmental Justice – 2%
- Other Strategies – 16%
  - Direct Benefit to DAC and/or Native American Communities – 4%
  - Schedule (i.e. Readiness to Proceed) – 8%
  - Inter-regional Project – 2%
  - Provide Non-Water Related Benefits – 2%
- Feasibility – 9%
  - Benefit-Cost Analysis – 6%
  - Financing/Economic Feasibility – 3%

5.3 Resource Management Strategies

> The IRWM Plan must document the range of Resource Management Strategies (RMS) considered to meet the IRWM objectives and identify which RMS were incorporated into the IRWM Plan.
>
> - *Proposition 84 & 1E IRWM Guidelines*, November 2012, Page 20

As described in the 2009 California Water Plan (CWP) Update, Resource Management Strategies (RMSs) are a diverse set of strategies to meet water-related resource management needs of each IRWM region (listed in Table 5-2). The ESRWMP has considered all of these CWP RMSs for inclusion in the East Stanislaus IRWMP and application in the region; those that were deemed appropriate and applicable have been included as shown in Table 5-2. A summary of the RMSs, their relevancy to the region, and the ability of achieving the regional objectives through RMS implementation are summarized in the following sections. The Regional Objectives' relation to the RMSs is shown in Table 5-3.

Table 5-2: RMS Incorporated into East Stanislaus IRWMP

RMS	Incorporated into IRWMP	RMS	Incorporated into IRWMP
Agricultural Water Use Efficiency	✓	Matching Quality to Use	✓
Urban Water Use Efficiency	✓	Pollution Prevention	✓
Conveyance – Delta		Salt and Salinity Management	✓
Conveyance – Regional/Local	✓	Urban Runoff Management	✓
System Reoperation	✓	Agricultural Lands Stewardship	✓
Water Transfers	✓	Economic Incentives (Loans, Grants, and Water Pricing)	✓
Conjunctive Management and Groundwater Storage	✓	Ecosystem Restoration	✓
Desalination		Forest Management	✓
Precipitation Enhancement	✓	Land Use Planning and Management	✓
Recycled Municipal Water	✓	Recharge Area Protection	✓
Surface Storage – CALFED		Water-Dependent Recreation	✓
Surface Storage – Regional/Local	✓	Watershed Management	✓
Drinking Water Treatment and Distribution	✓	Flood Risk Management	✓
Groundwater Remediation / Aquifer Remediation	✓	Other Strategies	✓

Agricultural Water Use Efficiency

This strategy aims at reducing net agricultural water use, focusing on improvements in technology and management of water, where appropriate, both on-farm and at the irrigation district level. This RMS is highly applicable to the East Stanislaus Region. A significant amount of water use in the region is for agricultural uses, and agricultural water use efficiency could be further applied, as is reasonable and cost-effective, contributing to water savings for the region. Agricultural water use efficiency measures are already being implemented in the region. For example, Modesto Irrigation District (MID) designed and installed a new irrigation control SCADA system providing new water management tools and improved operational efficiency of canals. MID and Turlock Irrigation District (TID) also recently prepared its 2012 Agricultural Water Management Plans, in accordance with the Agricultural Water Management Planning Act in SBx7-7, and have begun implementing the efficient water management practices as identified. The act requires water suppliers who provide water to 10,000 or more irrigated acres to develop and adopt a plan and implement cost-effective efficient water management practices. However, it is also important to recognize that agricultural applied water is a source of recharge to the underlying groundwater basins, and reduction in applied irrigation could lead to reductions in groundwater recharge. This irrigation-recharge connection will have to be considered in any project implementing this RMS. This RMS aligns with the Water Supply objective identified by the Region to implement water conservation plans for both urban and agricultural uses.

Urban Water Use Efficiency

Application of the Urban Water Use Efficiency RMS results in benefits to water supply and water quality through improvements in technology and human behavior to decrease both indoor and outdoor water use. While Agricultural Water Use Efficiency reduces water use on farms and through irrigation districts, Urban Water Use Efficiency applies to residential, commercial, industrial, and institutional water uses. This RMS is already being applied throughout the region through agency conservation programs, and will continue to be used in the future to manage water resources, contribute to drought preparedness, and reduce energy use and associated greenhouse gas (GHG) emissions. Similar to the Agricultural Water Use Efficiency RMS, application of this RMS would contribute to the objective to implement water conservation plans for both urban and agricultural uses.

Conveyance – Delta

Conveyance provides for the movement of water, and includes natural water courses such as streams, rivers, and groundwater aquifers, as well as constructed facilities such as ditches, canals, and pipelines. The Delta, located at the confluence of the Sacramento and San Joaquin Rivers, is composed of natural streams and sloughs, as well as artificial channels and constructed islands protected by levees that naturally convey water from the Sacramento and San Joaquin Rivers westward to the Pacific Ocean. Conveyance facilities within the Delta also pump water from it into canals that move water southward to urban and agricultural users. Delta conveyance can maintain or improve water supply reliability, protect water quality, provide water system operational flexibility, and improve the environment.

The East Stanislaus Region, while upstream of the Delta, is not in direct proximity to the Delta and would not utilize it for conveyance; therefore, this RMS is not applicable to the region.

Conveyance – Regional/Local

Various regional and interregional conveyance facilities exist throughout California and within the East Stanislaus Region. Interregional conveyance facilities, such as the State Water Project (SWP) and the federal Central Valley Project (CVP), move water throughout the state. Regional or local conveyance is when water is distributed to users from locally-developed sources, usually located within the same watershed or river system. Conveyance facilities can provide benefits to flood management, environmental uses, water quality, recreation, operational flexibility, and can be related to conjunctive use applications as well as urban and agricultural water use efficiency. This RMS would be implemented through the following:

- Improve existing conveyance systems, which could consist of improving aging infrastructure, increasing existing capacities, and adding new facilities.
- Upgrade distribution systems to improve efficiencies, improve water quality, and reduce energy demands.
- Construct new conveyance systems to replace or supplement existing systems.
- Maintain channel capacity.
- Add system interties to interconnect conveyance systems.

Water agencies and irrigation districts in the East Stanislaus Region rely on local conveyance every day and maintain their conveyance facilities to provide water supply reliability and flood control. The region will continue to rely on this RMS in the future. It aligns with the Region's Water Supply objective to address conveyance infrastructure needs.

System Reoperation

System reoperation consists of modifying the existing procedures for operation and management of water systems, including reservoirs and conveyance facilities. Oftentimes, system reoperation occurs to address a specific issue.

System Reoperation is an RMS that can be applied in the East Stanislaus Region. It will likely become more common in the future as populations continue to grow and climate change impacts are realized. As described in Section 2.3, climate change could alter the amount of snowpack in the Sierra Nevada, the timing of snowmelt, and runoff patterns which could greatly impact existing operations of water systems in the East Stanislaus region. System reoperation is one adaptive management strategy that the region can employ to address climate change impacts.

Water Transfers

The California Water Code defines a water transfer as a temporary or long-term change in the point of diversion, place of use, or purpose of use due to transfer or exchange of water rights. Transfers can be between water districts using, in general, one of the following methods to make water available for the transfer:

- Transfer water from storage that would be carried over to the next year.
- Transfer previously-banked groundwater by directly pumping and transferring that water or by pumping the banked groundwater for local use and transferring surface water that would have been used locally.
- Reduce existing consumptive use of water and transfer the excess.
- Reduce seepage from conveyance systems to make additional water available.

Water transfers can provide operational flexibility and can be linked to conjunctive management, groundwater banking, conveyance efficiency, agricultural and urban water use efficiency, and water quality improvement. This RMS will be included in the East Stanislaus IRWMP and considered both now and in the future to meet demands.

Conjunctive Management and Groundwater Storage

Conjunctive management is the planned use of surface water and groundwater resources to maximize availability and reliability of water supplies. For conjunctive management to be successful, groundwater storage must be feasible. Groundwater aquifers may be “recharged” from natural hydrologic process or water may be introduced to the aquifer through active groundwater management. Water can then be withdrawn through wells or it can discharge naturally, contributing to streamflow.

Conjunctive management is already relied upon by water managers in the region. For example, the City of Modesto relies on conjunctive use to meet demands with its water supplies from groundwater and Tuolumne River surface water that is purchased wholesale from MID. Turlock Irrigation District also manages its Turlock Groundwater Subbasin supplies conjunctively with its surface water supplies. Conjunctive management and groundwater will continue to be relied upon in the future.

Desalination

Desalination consists of the removal of salt from water to allow for the water’s beneficial use. In terms of the desalination RMS, it has typically focused on treating seawater or brackish water (water that has salt levels exceeding those acceptable for domestic, municipal, and irrigation uses).For inland areas, groundwater desalting is technically feasible and could be used in the region to address increasing groundwater salinities; however, as management strategy, it is expensive, energy intensive, and results in a waste brine that may be difficult to manage. As such, desalination will not be considered further for the East Stanislaus Region at this time.

Precipitation Enhancement

Cloud seeding, or precipitation enhancement, artificially stimulates clouds to precipitate by injecting artificial substances (usually silver iodide) into clouds that enable snowflakes and raindrops to form more easily. Precipitation enhancement has been performed in California since the early 1950s, with most of it occurring along the central and southern Sierra Nevada. A long-term precipitation enhancement project is planned for the North Fork of the Stanislaus River, sponsored by the Northern California Power Authority, with a primary goal of increasing hydroelectric power. According to the 2009 CWP Update, the cost of cloud seeding is typically less than $20 per acre-foot per year. In 2013, TID and MID entered its 25th year of its cloud seeding program. TID studies estimate that cloud seeding produces a 2% annual increase in total precipitation which translates to approximately 40,000 acre-feet per year (Cantatore, 2010). This is and will continue to be valuable in the future as climate change impacts occur.

Recycled Municipal Water

One RMS commonly applied throughout California to increase available water supplies and meet current and future water demands is the use of Recycled Municipal Water, consisting of treating and reusing wastewater. Recycled water can offset potable water supplies, diversify a water agency’s water supply portfolio, creating a more drought resistant supply and beneficially reusing wastewater. The East Stanislaus Region recognizes the importance of maximizing use of recycled water, as demonstrated in its Water Supply objective to provide a variety of water supply sources, including recycled water, to meet all current and future demands under various hydrologic conditions, and plans to expand application in and around the region.

Surface Storage – CALFED

DWR, the Bureau of Reclamation, and local water interests are investigating five potential reservoirs for surface water storage as part of the CALFED Record of Decision. These include the Shasta Lake Water Resources Investigation, North-of-the-Delta Offstream Storage, In-Delta Storage Project, Los Vaqueros Reservoir Expansion, and the Upper San Joaquin River Basin Storage Investigation. Because none would apply to the East Stanislaus Region, this RMS is not being considered for future application or incorporation into the IRWMP.

Surface Storage – Regional/Local

Relying on surface storage, consisting of reservoirs to collect water for later release and use, is often necessary throughout California. Surface storage can also be operated in conjunctive with groundwater storage to create conjunctive use opportunities. Modesto Reservoir and Turlock Lake lie within the East Stanislaus Region and are used by MID and TID, respectively, for surface storage. Regional and local surface storage will continue to be used for water management in the East Stanislaus Region. The addition or expansion of reservoirs could be an option for increased water supplies in the future, if deemed necessary.

Drinking Water Treatment and Distribution

Drinking water treatment and distribution is a key RMS to achieving the region's Water Supply and Water Quality goals and objectives. Providing a high quality, reliable drinking water supply to users is the primary goal of public water systems. The water agencies in the East Stanislaus Region apply this RMS every day, and will continue doing so through maintenance of existing water treatment and distribution facilities and the addition of new facilities, as necessary to meet demands.

Groundwater and Aquifer Remediation

Groundwater in aquifers throughout the state has degraded water quality that prevents beneficial use. In some areas, groundwater quality is degraded by naturally occurring constituents while other areas, poor water quality is caused by a variety of human activities. In order to allow for use of the degraded groundwater as a drinking water supply, groundwater and/or aquifer remediation may be required. Groundwater remediation removes contaminants that affect the beneficial use of the groundwater and can consist of the following methods:

- Passive groundwater remediation: allowing contaminants to biologically or chemically degrade or disperse in-situ over time.
- Active groundwater remediation: treating contaminated groundwater in-situ or extracting contaminated groundwater and then treating it. When groundwater is extracted, treated, and then injected back into the aquifer, it is commonly referred to as a 'pump and treat system'. If groundwater is pumped, treated, and then delivered to users for potable, irrigation or industrial use, it is referred to as wellhead treatment.

The East Stanislaus Region's groundwater quality is variable and has been impacted by overlying land uses in many locations. For this reason, treating the pumped groundwater prior to delivery (i.e. active groundwater remediation) is necessary. Groundwater monitoring for groundwater levels and quality is conducted and will continue to be; if contaminants spread or groundwater quality worsens, or if water quality regulations are modified, additional groundwater and/or aquifer remediation could be required in the future.

Matching Quality to Use

Not all water uses require the same quality of water. High quality water can be used for potable water supplies while a water of less quality, such as recycled water, may be appropriate for uses other than drinking water. The East Stanislaus Region plans on expanding recycled water use, initiating storm water capture and reuse, and expanding the non-potable use of degraded aquifer supplies. By applying this RMS, the Region will match quality to use in other water resource applications both at present and in the future.

Pollution Prevention

Pollution prevention is the protection of water quality at its source, oftentimes through land use management practices to prevent sediment and pollutants from entering the source water. It can not only improve water quality for all beneficial uses, but also reduce the cost for other water management and treatment processes. This RMS would help meet the Water Quality goals and objectives for the Region. The Region has and will continue to apply this RMS.

Salt and Salinity Management

With the exception of freshly fallen snow, salt, or materials originating from dissolution or weathering of rocks and soil, is present in most natural water supplies because soluble salts in rocks and soil begin dissolving as soon as water reaches them. Recycled water applications can increase salinity, and while living organisms benefit from low levels of salt concentrations, salinity can become a problem when consumptive use and evaporation concentrates salts to levels that adversely impact beneficial uses. The Central Valley Salinity Alternatives for Long-term Sustainability initiative (CV-SALTS), a collaborative effort initiated in 2006 by the Central Valley Salinity Coalition, was created to find a solution to the rising salt levels in the Central Valley that have the potential to impact drinking water quality and productive crops throughout the basin. It is the Salt and Nutrient Planning effort in the Central Valley region as indicated by the RWQCB. The City of Modesto has been participating in CV-SALTS and plan on continuing its membership. The Region continues managing salt and applying this RMS through participation in CV-SALTS, as well as other methods. This RMS will help achieve the Water Supply and Water Quality goals and objectives identified for the East Stanislaus Region.

Urban Runoff Management

Urbanization, through increased impervious surfaces, alters flow paths, water storage, pollutant levels, evapotranspiration, groundwater percolation and recharge, surface runoff and many other natural processes. Urban runoff management is the management of stormwater and dry weather runoff (e.g. excess landscape irrigation water flows to the storm drain) typically for flood control and pollution prevention. This RMS focuses on a watershed focused approach for urban runoff management through the implementation of best management practices (BMPs) and Low Impact Development (LID) in which the natural hydrologic cycle can be emulated and preserved. The BMPs are designed to reduce pollutant loading, reduce the volumes of runoff, and reduce velocities of urban runoff discharged to surface waters. LID creates site designs and applies BMPs that maintain the site's pre-development runoff rates and volumes. The East Stanislaus Region manages urban runoff in the more traditional sense in which stormwater is collected and conveyed through storm drains and pipes. The Region will continue applying this RMS and in the future, identify opportunities to apply a watershed approach of urban runoff management and to manage stormwater runoff through capture and reuse.

Agricultural Lands Stewardship

Agricultural lands stewardship consists of conserving natural resources and protecting the environment while improving land for food, fiber and biofuels production, watershed function, soil, air, energy, plant and animal and other conservation purposes. It can help attenuate peak precipitation runoff, conserve water, facilitate groundwater recharge, provide critical habitat, sequester carbon, and also maintain production of food and fiber. The economy of the East

Stanislaus Region is distinguished by its large agricultural sector. Protection of these lands, and therefore implementation of this RMS is already underway and it will continue to be implemented in the future, helping meet the Environmental Protection and Enhancement goal and objectives.

Economic Incentives (Loans, Grants, and Water Pricing)

Economic incentives can be provided to influence the amount and timing of water use, wastewater volume generated, and sources of water supplies. Economic incentives generally come in the form of financial assistance such as low interest loans and grants, water pricing (e.g. water rates), and rebates or free services. The most common water rate policy is for water suppliers to recover costs for planning, operation and maintenance, capital, and administration costs for water-related projects. All of the water suppliers in the East Stanislaus Region use rate structures to fund their capital, water enterprise, and general funds and some offer rebates to encourage the use of water conserving fixtures. Economic pricing can be used to encourage the continued use of surface water, rather than moving to groundwater when implementing advanced irrigation practices. Keeping surface water economically priced can also help to implement conjunctive use, and improve groundwater conditions. This RMS will continue to be relied upon to promote and implement efficient water management practices for both urban and agricultural uses, a Water Supply objective for the region, as well as continue to fund needed projects and offset costs for low-income and disadvantaged communities.

Ecosystem Restoration

The Ecosystem Restoration RMS aligns directly with the Environmental Protection and Enhancement goal and objectives for the Region. Ecosystem restoration for the purposes of this RMS includes the restoration of aquatic, riparian, and floodplain ecosystems as they are most directly affected by water and flood management activities. Restoration can be completed as stand-alone projects, or aspects of ecosystem restoration can be incorporated into water resources-related projects to create multi-benefit projects. This RMS is incorporated into the East Stanislaus IRWMP.

Forest Management

The East Stanislaus Region's water supplies originate from high elevation forests in the Sierra Nevada. Forests in California are used for sustainable production of resources such as water, timber, native vegetation, fish, wildlife, livestock, and recreation opportunities. Forest management can directly impact water quantity and quality. This RMS focuses on forest management activities that improve availability and quality of water for downstream users. A portion of the Stanislaus National Forest lies within the eastern portion of the East Stanislaus Region. The Forest Management RMS can be applied there which will benefit the entire East Stanislaus Region and help contribute to the Water Supply, Water Quality, Flood Protection, and Environmental Protection and Enhancement goals and objectives.

Land Use Planning and Management

The Land Use Planning and Management RMS focuses on integrating land use and water management to plan for housing and economic development needs while providing for efficient use of water, water quality, energy, and other resources. The way land is used (i.e. land use type) directly affects water supply and quality and flood management. This RMS relates to the Water Supply, Water Quality, Flood Protection, and Environmental Protection and Enhancement goals and objectives. The Region has, and will continue to, apply this RMS, integrating land use with water resource management.

Recharge Area Protection

Recharge areas are locations where groundwater is replenished through percolation. Ideal natural recharge areas are those areas that allow for high quality water to percolate through sediments and rocks to the underlying groundwater basins. Protection of recharge areas consists of ensuring recharge areas continue to allow recharge, rather than being covered by urban infrastructure (impervious areas), and preventing pollutants from contaminating the groundwater that has recharged the area. This RMS is required in order to maintain groundwater quantity and quality. The East Stanislaus Region has, and will continue to, apply this RMS in order to achieve its Water Supply and Water Quality goals and objectives.

Water-Dependent Recreation

The East Stanislaus Region has many opportunities for water-dependent recreation such as fishing, swimming, waterfowl hunting and birding, boating, canoeing and kayaking. The upper reaches of the Tuolumne River are known for whitewater rapids for rafting. The lower reaches of the Tuolumne River, Modesto Reservoir, New Don Pedro Reservoir, and Turlock Lake are recreation areas offering opportunities for boating, swimming, birding, and fishing. There are areas throughout the Region, that while they do not depend on water are enhanced by being near water, that allow for hiking, biking, picnicking, camping, and wildlife viewing. Water planners can incorporate water-dependent recreation opportunities as part of water projects. This RMS has been applied, and will continue to be, in order to help achieve the objective to identify opportunities for open spaces, trails, and parks along creeks and other recreational projects in the watershed to be incorporated with water supply, water quality, or flood protection projects.

Watershed Management

The Watershed Management RMS consists of creating and implementing plans, programs, and projects to restore and enhance watershed functions to meet the diverse needs of communities that depend on it. Using watersheds as organizing units for planning and implementing projects is made possible in the East Stanislaus Region by integrated regional water management planning. The Region's Regional Communication and Cooperation goals and objectives align with this RMS, which is incorporated into the East Stanislaus IRWMP.

Flood Risk Management

The Flood Risk Management RMS would help achieve the Flood Protection goal identified by the Region, to ensure flood protection strategies are developed and implemented through a collaborative process, utilizing both local and watershed-wide approaches designed to maximize opportunities for comprehensive water resource management, and its associated objectives. The East Stanislaus Region is participating in the development of the Central San Joaquin River Regional Flood Management Plan, and through this and other processes, will implement the objectives for achieving its Flood Management goal. Therefore, the Region's goals and objectives are aligned with this RMS and are therefore incorporated into the IRWMP.

Other Strategies

Other RMSs such as crop idling, irrigated land retirement, fog collection, rainfed agriculture, dewvaporation, and waterbag transport are identified in the 2009 CWP. While some of the RMSs are feasible (such as crop idling, irrigated land retirement and rainfed agriculture), they would be applied only in the most desperate of circumstances. Most likely, unless all other RMSs have been exhausted, the East Stanislaus Region would not apply these strategies as they could have substantial economic impacts; as such, these strategies will not be considered further at this time.

5.4 Relation to Statewide Priorities

A Program Preference identified by DWR in the 2012 IRWM Guidelines is to address statewide priorities, which include:

- Drought Preparedness
- Use and Reuse Water More Efficiently
- Climate Change Response Actions
- Expand Environmental Stewardship
- Practice Integrated Flood Management
- Protect Surface Water and Groundwater Quality
- Improve Tribal Water and Natural Resources
- Ensure Equitable Distribution of Benefits

The goals and objectives identified for the East Stanislaus Region align with DWR's Statewide Priorities. All Statewide Priorities have been included in the Region's project prioritization process, and therefore all would be achieved by IRWM projects that contribute to the Region's objectives. The Regional Objectives' relation to the Statewide Priorities is shown in Table 5-4.

Achieving objectives, when integrated with the Statewide Priorities and Resource Management Strategies, will result in a multi-benefit solution meeting the Region's needs, as well as the State's priorities and preferences.

Table 5-3: East Stanislaus Regional Objectives' Relation to RMSs

Goal	Objective	Resource Management Strategies																										
		Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Risk Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Watershed Management	Other Strategies
Water Supply - Protect existing water supplies and water rights, and improve regional water supply reliability	Provide a variety of water supply sources, including recycled water, to meet all current and future demands (urban, agricultural and the environment) under various hydrologic conditions.						✓						✓	✓		✓		✓	✓	✓		✓	✓	✓				
	Promote the use of groundwater storage and conjunctive use options to reduce groundwater overdraft.					✓							✓	✓						✓			✓	✓			✓	
	Protect existing water rights.				✓	✓	✓							✓				✓	✓			✓	✓		✓			
	Implement water conservation plans for both urban and agricultural uses.	✓	✓							✓																		
	Support monitoring and research to improve understanding of water supplies and needs.																				✓			✓	✓		✓	
	Address conveyance infrastructure needs.	✓	✓		✓			✓											✓						✓			
Flood Protection - Ensure flood protection strategies are developed and implemented through a collaborative process, utilizing both local and watershed-wide approaches designed to maximize opportunities for comprehensive water resource management	Develop outlines of regional projects and plans necessary to protect infrastructure from flooding and erosion from the 100-year event.							✓																	✓		✓	
	Work with stakeholders to preserve existing flood attenuation by implementing land management strategies throughout the watershed.							✓			✓	✓									✓				✓		✓	
	Develop approaches for adaptive management that minimizes maintenance requirements and protects water quality and availability while preserving and enhancing ecologic and stream functions, as appropriate.							✓			✓														✓		✓	
	Provide community benefits beyond flood protection, such as public access, open space, recreation, agricultural preservation, and economic development.							✓	✓																	✓	✓	
	Protect, restore, and enhance the natural ecological and hydrologic functions of rivers, creeks, streams and their floodplains.							✓			✓														✓		✓	

		Resource Management Strategies																										
Goal	Objective	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Risk Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Watershed Management	Other Strategies
Water Quality - Protect and improve water quality for beneficial uses consistent with regional interests and the RWQCB Basin Plan in cooperation with local, state and federal agencies and regional stakeholders	Meet or exceed all applicable water quality regulatory standards.												✓			✓			✓	✓		✓	✓	✓				
	Deliver agricultural water to meet water quality guidelines established by stakeholders.	✓							✓							✓				✓		✓	✓	✓				
	Aid in meeting Total Maximum Daily Loads established, or to be established, for the Tuolumne River watershed.								✓	✓	✓									✓	✓		✓					
	Protect surface waters and groundwater basins from contamination and threat of contamination.										✓	✓	✓							✓	✓	✓	✓	✓	✓			
	Manage existing land uses while preserving or enhancing environmental habitats.								✓		✓	✓	✓								✓		✓		✓		✓	
	Minimize impacts from storm water through implementation of Best Management Practices, Low Impact Development or other similar projects.							✓			✓	✓									✓		✓	✓	✓		✓	
	Promote programs and projects to reduce the quantity and improve the quality of urban and agricultural runoff.	✓	✓						✓	✓											✓		✓		✓		✓	
	Promote and support regional monitoring to further understanding of water quality issues.												✓										✓				✓	
Environmental Protection and Enhancement - Protect the environmental resources of the Stanislaus, Tuolumne, Merced and San Joaquin River watersheds by identifying, promoting and implementing opportunities to assess, restore and enhance natural resources of these watersheds	Identify and incorporate (where possible and reasonable) opportunities to assess, protect, enhance, and/or restore natural resources when developing water management strategies.							✓			✓	✓									✓						✓	
	Minimize adverse effects on biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological sites when implementing strategies and projects.										✓		✓								✓						✓	
	Identify opportunities for open spaces, trails and parks along creeks and other recreational projects in the watershed to be incorporated with water supply, water quality, or flood protection projects.										✓										✓					✓	✓	
	Contribute to the long-term sustainability of agricultural, commercial, industrial, and urban land uses and activities within the basin.	✓	✓			✓		✓	✓					✓		✓		✓		✓	✓	✓	✓	✓	✓		✓	

Goal	Objective	Resource Management Strategies																										
		Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Risk Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Watershed Management	Other Strategies
	Identify opportunities to protect, enhance, or restore habitat to the support all watersheds in the Region in conjunction with water supply, water quality, or flood protection projects.							✓			✓		✓								✓						✓	
	Support projects to understand, protect, improve and restore the region's ecological resources.										✓										✓						✓	
Regional Communication and Cooperation - Implement and promote this IRWM Plan through regional communication, cooperation, and education	Develop a forum for consensus decision-making and IRWM Plan implementation by regional entities.																				✓			✓			✓	
	Build relationships with State and Federal regulatory agencies and other water forums and agencies to facilitate permitting of water-related projects and ensure continued consistency with state water plans.																				✓						✓	
	Facilitate dialogues between regional and inter-regional entities to reduce inconsistencies and conflicts in water management and to maximize benefits from water-related projects.																				✓							
	Maintain avenues of communication with the general public and offering opportunities to provide feedback on the IRWM and water-related projects through the regional websites and other public forums.																											
	Identify opportunities for public education about water supply, water quality, flood management, and environmental projection.								✓																			
Economic and Social Responsibility - Promote development and implementation of projects, programs and policies that are socially impartial and economically sound	Support the participation of disadvantaged communities in the development, implementation, monitoring and long-term maintenance of water resource projects.																											
	Develop cost-effective multi-benefit projects.																				✓						✓	
	Consider disproportionate community impacts to ensure environmental justice.																											
	Maximize economies of scale and governmental efficiencies.															✓												
	Protect cultural resources.																				✓							
	Reduce energy use and/or use of renewable resources where appropriate.															✓			✓			✓						

Table 5-4: East Stanislaus Regional Objectives' Relation to Statewide Priorities

Goal	Objective	Statewide Priority							
		Drought Preparedness	Use & Reuse Water More Efficiently	Climate Change Response Actions	Expand Environmental Stewardship	Practice Integrated Flood Mngmt	Protect Surface Water & GW Quality	Improve Tribal Water & Natural Resources	Ensure Equitable Distrib. of Benefits
Water Supply - Protect existing water supplies and water rights, and improve regional water supply reliability	Provide a variety of water supply sources, including recycled water, to meet all current and future demands (urban, agricultural and the environment) under various hydrologic conditions.	✓	✓	✓			✓		
	Promote the use of groundwater storage and conjunctive use options to reduce groundwater overdraft.	✓		✓			✓		
	Protect existing water rights.	✓	✓	✓	✓		✓		
	Implement water conservation plans for both urban and agricultural uses.	✓	✓	✓				✓	✓
	Support monitoring and research to improve understanding of water supplies and needs.			✓		✓		✓	
	Address conveyance infrastructure needs.	✓	✓	✓		✓		✓	✓
Flood Protection - Ensure flood protection strategies are developed and implemented through a collaborative process, utilizing both local and watershed-wide approaches designed to maximize opportunities for comprehensive water resource management	Develop outlines of regional projects and plans necessary to protect infrastructure from flooding and erosion from the 100-year event.			✓	✓	✓		✓	✓
	Work with stakeholders to preserve existing flood attenuation by implementing land management strategies throughout the watershed.					✓			✓
	Develop approaches for adaptive management that minimizes maintenance requirements and protects water quality and availability while preserving and enhancing ecologic and stream functions, as appropriate.				✓	✓	✓		
	Provide community benefits beyond flood protection, such as public access, open space, recreation, agricultural preservation, and economic development.					✓		✓	✓
	Protect, restore, and enhance the natural ecological and hydrologic functions of rivers, creeks, streams and their floodplains.				✓	✓			
Water Quality - Protect and improve water quality for beneficial uses consistent with regional interests and the RWQCB Basin Plan in cooperation with local, state and federal agencies and regional stakeholders	Meet or exceed all applicable water quality regulatory standards.						✓		
	Deliver agricultural water to meet water quality guidelines established by stakeholders.						✓		
	Aid in meeting Total Maximum Daily Loads established, or to be established, for the Tuolumne River watershed.						✓		
	Protect surface waters and groundwater basins from contamination and threat of contamination.						✓		
	Manage existing land uses while preserving or enhancing environmental habitats.				✓		✓		
	Minimize impacts from storm water through implementation of Best Management Practices, Low Impact Development or other similar projects.						✓		
	Promote programs and projects to reduce the quantity and improve the quality of urban and agricultural runoff.						✓		
	Promote and support regional monitoring to further understanding of water quality issues.						✓		
Environmental Protection and Enhancement - Protect the environmental resources of the Stanislaus, Tuolumne, Merced and San Joaquin River watersheds by identifying, promoting and implementing opportunities to assess, restore and enhance natural resources of these watersheds	Identify and incorporate (where possible and reasonable) opportunities to assess, protect, enhance, and/or restore natural resources when developing water management strategies.				✓				
	Minimize adverse effects on biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological sites when implementing strategies and projects.				✓			✓	
	Identify opportunities for open spaces, trails and parks along creeks and other recreational projects in the watershed to be incorporated with water supply, water quality, or flood protection projects.	✓	✓	✓	✓	✓	✓	✓	✓
	Contribute to the long-term sustainability of agricultural, commercial, industrial, and urban land uses and activities within the basin.	✓	✓	✓	✓		✓	✓	✓

Goal	Objective	Statewide Priority							
		Drought Preparedness	Use & Reuse Water More Efficiently	Climate Change Response Actions	Expand Environmental Stewardship	Practice Integrated Flood Mngmt	Protect Surface Water & GW Quality	Improve Tribal Water & Natural Resources	Ensure Equitable Distrib. of Benefits
	Identify opportunities to protect, enhance, or restore habitat to the support all watersheds in the Region in conjunction with water supply, water quality, or flood protection projects.	✓	✓	✓	✓	✓	✓	✓	✓
	Support projects to understand, protect, improve and restore the region's ecological resources.				✓			✓	
Regional Communication and Cooperation - Implement and promote this IRWM Plan through regional communication, cooperation, and education	Develop a forum for consensus decision-making and IRWM Plan implementation by regional entities.	✓	✓	✓	✓	✓	✓	✓	✓
	Build relationships with State and Federal regulatory agencies and other water forums and agencies to facilitate permitting of water-related projects and ensure continued consistency with state water plans.	✓	✓	✓	✓	✓	✓	✓	✓
	Facilitate dialogues between regional and inter-regional entities to reduce inconsistencies and conflicts in water management and to maximize benefits from water-related projects.	✓	✓	✓	✓	✓	✓	✓	✓
	Maintain avenues of communication with the general public and offering opportunities to provide feedback on the IRWM and water-related projects through the regional websites and other public forums.	✓	✓	✓	✓	✓	✓	✓	✓
	Identify opportunities for public education about water supply, water quality, flood management, and environmental projection.	✓	✓	✓	✓	✓	✓	✓	✓
Economic and Social Responsibility - Promote development and implementation of projects, programs and policies that are socially impartial and economically sound	Support the participation of disadvantaged communities in the development, implementation, monitoring and long-term maintenance of water resource projects.		✓					✓	✓
	Develop cost-effective multi-benefit projects.	✓	✓	✓	✓	✓	✓	✓	✓
	Consider disproportionate community impacts to ensure environmental justice.				✓			✓	✓
	Maximize economies of scale and governmental efficiencies.							✓	✓
	Protect cultural resources.							✓	✓
	Reduce energy use and/or use of renewable resources where appropriate.			✓				✓	✓

5.5 Relation to Regulatory Programs

The East Stanislaus Region falls under the purview of the U.S. Environmental Protection Agency (USEPA) Region 9, U.S. Fish and Wildlife Service (USFWS) Southwest Region, the Central Valley (Region 5) Regional Water Quality Control Board (RWQCB), the San Joaquin District of the California Department of Water Resources (DWR), the California Department of Public Health (CDPH), and the California Department of Fish and Wildlife (CDFW), Central Region. Most water resources management activities fall under the oversight of one or more of these agencies. Examples of activities requiring coordination with these areas include preparation of this IRWMP (completed using the guidelines issued by DWR); water treatment plant operations and potable water distribution (conducted under the oversight of CDPH); and discharges of treated wastewater to the San Joaquin River (CDFW and RWQCB). Direct and indirect regulatory agency participation has been sought by the East Stanislaus Region for participation on the SC or PAC; however, most region coordination with these State and Federal regulatory agencies is on a project-by-project basis.

5.6 Relation to Local Water Planning

Historically, there have not been any official IRWM planning efforts in the East Stanislaus Region, but entities within the East Stanislaus Region have worked together on various local water planning efforts and water projects over the years and have maintained an ongoing collaborative relationship through groundwater management groups, Directors meetings, and other efforts. Some of the historical water-related planning efforts are project-based, while others are related to a broader discussion of water resources-related issues. The cities and agencies within the East Stanislaus Region have worked together to develop solutions to the water management issues and conflicts they face. This IRWMP provides an integrated venue under which these historical efforts can continue on a programmatic level. It is anticipated that project-specific coordination will continue independent of the IRWMP implementation, as needed, for development, construction and operation of projects required to meet the region's water resource management needs.

> The IRWMP must document the local water planning documents on which it is based including:
> - A list of local water plans used in the IRWM Plan.
> - A discussion of how the IRWM Plan relates to planning documents and programs established by local agencies.
> - A description of the dynamics between the IRWM Plan and local planning documents.
>
> - *Proposition 84 & 1E IRWM Guidelines*, November 2012, Page 22

Some of the historical local water planning efforts that have laid the foundation for the East Stanislaus IRWMP are described in the following sections. A list of local plans used in the development of the IRWMP is included in Chapter 6, Technical Analysis (see Table 6-1).

5.6.1 Groundwater Management Planning

The Turlock Groundwater Basin Association (TGBA) was created for cooperative groundwater management activities in the Turlock Groundwater Basin. Agencies in TGBA include the Turlock and Merced Irrigation Districts; the cities of Ceres, Turlock, Modesto and Hughson; the Hilmar and Delhi County Water Districts; the Keyes, Denair and Ballico Community Services Districts; the Eastside and Ballico-Cortez Water Districts; and Stanislaus and Merced Counties. Since the mid-1990s, the TGBA has coordinated as follows.

- Pursuant to State Law, the purpose of the TGBA is to coordinate groundwater management activities within the Turlock Groundwater Basin. The guiding document for the TGBA is the *Groundwater Management Plan* (GWMP), prepared and adopted pursuant to state legislation (Assembly Bill [AB] 3030) signed into law January 1, 1993. The first GWMP was adopted in 1997; it was updated and re-adopted in 2008 to reflect current conditions in the basin area. The TGBA will continue to coordinate in the future and update the GWMP, as necessary, in order to successfully coordinate groundwater management activities in the basin.
- A water balance study of the Turlock Subbasin was prepared in 2003 and updated in 2007 to estimate the inflows and outflows from the subbasin between 1952 and 2006. Recent groundwater data indicate that the basin may no longer be in a state of equilibrium (that is, outflows have started to exceed inflows). While there is uncertainty about the causes, it is believed to be a combination of increased urbanization, recent dry years, and increased agricultural production (acreage) in the eastern hills (Turlock Lake area) which relies solely on groundwater for irrigation. The water balance study highlighted the importance of studying the issue in more detail and for member agencies to collaborate more closely on groundwater management issues within the entire subbasin area.
- In response to the requirements of Senate Bill (SB) x7-6, the TGBA submitted an application to DWR to comply with requirements as a Cooperative Groundwater Monitoring Association. This has necessitated the formation of a SBx7-6 Committee to assist in coordinating compliance activities including, but not limited to: representing the TGBA at meetings regarding SBx7-6; development of draft submittals to DWR for TGBA's approval; and coordinating implementation of a monitoring program with DWR and local agencies.
- Submitted an application for, and was awarded in 2013, a Local Groundwater Assistance grant to study the geology of the far eastern side of the Turlock Subbasin, to update and refine the local groundwater model and the future needs study, and to identify additional monitoring locations in nearly planted areas to the east.

The Cities of Modesto, Oakdale and Riverbank, MID, Oakdale Irrigation District, and Stanislaus County are members of the Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA) which was formed in 1994. The purpose of the association is to manage the groundwater resources within the Modesto Groundwater Basin. The STRGBA developed and adopted an *Integrated Regional Groundwater Management Plan* (IRGMP) in 2005 pursuant to state legislation SB1938. The STRGBA is working with the United States Geological Survey (USGS) through a contract for developing a numerical groundwater model for the Modesto Groundwater Basin. This effort will characterize the basin and provide modeling capabilities for various groundwater scenarios. To comply with SBx7-6 State legislation requiring groundwater monitoring, passed in 2009, the STRGBA submitted an application to the DWR stating its intent as a Cooperative Groundwater Monitoring Association to submit a groundwater monitoring program for the Modesto sub-basin.

The STRGBA also received a $250,000 grant under the AB303 legislation to develop a Well Field Optimization Program. Phase 1 of this program is to develop and implement the first of the nine IRGMP management actions; more specifically, to operate wells to meet water supply demands, lower pumping power costs and prioritize well usage, maintain groundwater levels to satisfy Basin Management Objectives (BMOs), manage quality of discharge water and, increase effectiveness of shallow groundwater management. This study was completed in June 2007. Phase 2 expands the program to include aspects specific to urban purveyors of groundwater, but with similar goals of facilities inventory and maintaining groundwater levels to satisfy BMOs. More recently, the

STRGBA submitted an application for, and was awarded in 2013, a Local Groundwater Assistance grant to study the eastern side of the Modesto Subbasin to identify areas for potential groundwater recharge and to develop conceptual ideas for possible groundwater augmentation projects to support basin-wide conjunctive use.

5.6.2 Groundwater Elevation Monitoring/CASGEM

Senate Bill x7 6 added provisions for groundwater monitoring to Division 6 of the California Water Code and authorized DWR to establish permanent, locally managed, groundwater elevation monitoring and reporting in all of California's alluvial groundwater basins. To meet this legislative requirement, DWR developed the California Statewide Groundwater Elevation Monitoring (CASGEM) program to establish a program of regular and systematic monitoring of groundwater elevations and to track seasonal and long-term trends in groundwater elevations statewide.

A core component of CASGEM is the identification of Monitoring Entities in each groundwater basin/subbasin. Monitoring Entities are responsible for coordinating the groundwater elevation monitoring and reporting for their jurisdictional area, with groundwater elevation monitoring beginning in the Fall of 2011, and elevation reporting to DWR by January 1, 2012. TGBA and STRGBA have respectively registered to become the Monitoring Entities for the Turlock and Modesto Subbasins of the San Joaquin Valley Groundwater Basin.

5.6.3 Groundwater Quality Monitoring

In 2006, the State Water Resources Control Board (SWRCB) conducted an investigation in the Central Eastside study unit, overlying the Modesto and Turlock Subbasins, as part of the Statewide Basin Assessment Project of the Groundwater Ambient Monitoring and Assessment (GAMA) Program. The GAMA program was developed in response to the Groundwater Quality Monitoring Act of 2001 and was conducted in coordination with the USGS and the Lawrence Livermore National Laboratory (LLNL). The one-time study was conducted to provide a spatially unbiased assessment of raw groundwater for comparing water quality. Data collected during the study is available online at the SWRCB's Geotracker GAMA website at http://www.waterboards.ca.gov/gama/geotracker_gama.shtml. This website currently integrates data from the SWRCB, the RWQCBs, CDPH, the California Department of Pesticide Regulation, DWR, USGS and LLNL.

At present, all water agencies and irrigation districts in the East Stanislaus Region rely partially or wholly on groundwater wells. Active municipal supply wells have to be tested per CDPH regulations on an annual basis. Groundwater quality is reported by water agencies annually to the public as part of their consumer confidence reporting and to CDPH as part of their permit requirements. Further, CASGEM requires some basic water quality testing and reporting in the wells that are monitored as part of the CASGEM program. Finally, the Irrigated Lands Regulatory Program and the Dairy Program are also monitoring groundwater quality in the region. The Irrigated Lands Regulatory Program began in 2003 to prevent agricultural runoff from impairing surface waters. Under the program waste discharge requirements were developed to protect both surface and groundwater. The first in a series of waste discharge requirements were adopted by the Central Valley Water Board in December 2012; others are planned to be developed for all regions in the Central Valley by mid-2014. Additionally, as part of this program, if there are two or more exceedances of the same pollutant at the same site within a three year period, management plans must be prepared and implemented. The Irrigated Lands Regulatory Program provides public access to monitoring reports, management plans, and water quality data collected since 2004. Data collected under the program can be accessed through the California Data Exchange Network (CEDEN). The Dairy Program has a General Order for Existing Milk Cow Dairies requiring monitoring and reporting in the Central Valley Region. Monitoring of discharges of manure and/or process wastewater, stormwater, or tailwater from dairy production is required to minimize leaching of nutrients and salts to groundwater and nearby surface waters. This program requires dischargers submit annual reports to the Central Valley Water Board.

5.6.4 Salt & Nutrient Management Planning

As previously stated, the City of Modesto is a member of the Central Valley Salinity Coalition, a non-profit coalition of public agencies, businesses, associations, and other members, formed in July 2008 with the purpose of better managing salts in the Central Valley of California. The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) program is being led by the Coalition to find solutions to the Central Valley salt problem, and in February 2010, the organization completed the *Salt and Nitrate Sources Pilot Implementation Study*. The purpose of the study was to develop a methodology and provide guidance for development of the Central Valley Salt and Nutrient Management Plan (SNMP), including methods for quantifying salt and nutrient (or nitrate) sources. The identified methods were pilot tested to evaluate their appropriateness and effectiveness. Following completion of the pilot study, the Coalition developed a *Framework for Salt/Nitrate Source Identification Studies*, which has now led to preparation of the Initial Conceptual Model (ICM), currently underway. The ICM is the first phase of a three-phased effort to develop the technical and regulatory basis for the SNMP. The ICM will consist of a conceptual level analysis of the water balance in the Central Valley and the associated salt and nutrient conditions. The result of the ICM will be an assessment of the salt and nutrient conditions in the Central Valley. Phases 2 and 3 of the ICM will consist of refining the findings from Phase 1, delineating management zones, and developing the SNMP which will include preparation of a salt and nutrient program of implementation and completion of regulatory analyses to support adoption of the SNMP in the Central Valley RWQCB's Basin Plan. Development of the ICM began in September 2012 and is anticipated to be completed in May 2013. The results of Phases 1 through 3 will be incorporated into future East Stanislaus IRWMP updates, and the resulting SNMP will contribute to IRWM planning in the region as the phases are completed.

5.6.5 Water Planning Efforts

In addition to the development of agency-specific Water Master Plans, Urban Water Management Plans (UWMPs) and Agricultural Water Management Plans (AWMPs) in the Region, agencies within the Region have coordinated on regional and joint-projects and programs. Some of these are described as follows:

- *Regional Surface Water Supply Project (RSWSP).* For the past several years, the Cities of Turlock, Modesto, Ceres and Hughson have been negotiating with TID to receive treated water from the Tuolumne River to supplement current potable water supplies. On September 27, 2011, a Joint Powers Agreement (JPA) was executed between the cities of Turlock, Modesto and Ceres to establish the Stanislaus Regional Water Authority (SRWA). The member agencies of the SRWA are all heavily or entirely dependent upon groundwater as their source of water supply and groundwater is a diminishing resource in the region. Each of the Participants is authorized to develop, obtain, and serve a municipal and industrial water supply, pursuant to California law. It is anticipated that the SRWA's Regional Surface Water Supply Project (RSWSP) will result in a safe, dependable, economical and long term municipal and industrial water supply system. The SRWA creates a forum and decision-making body to collectively discuss, develop and negotiate alternatives regarding the RSWSP. The intent of the Joint Powers Authority is to develop the RSWSP whereby the SRWA would purchase water from the Turlock Irrigation District, treat such water in an SRWA-owned and operated water treatment plant, and make the treated water available at cost to the members of the SRWA.

- *Modesto Regional Water Treatment Plant (MRWTP) Phases 1 & 2.* This is an on-going effort between the City of Modesto and the MID to deliver treated Modesto Reservoir surface water to the City of Modesto and other adjacent communities adjacent for which Modesto owns and operates the water systems. In 1992, the City and MID entered into a Treatment and Delivery Agreement to construct Phase 1 of the MRWTP, consisting of fourteen miles of conveyance piping, two terminal reservoir tanks and pumping facilities for the delivery of 30 million gallons per day (mgd) of potable water. Since 1995, Modesto has been receiving these surface water deliveries. In 2005, the City and MID entered into an Amended and Restated Treatment and Delivery Agreement to construct Phase 2 of the MRWTP, which would increase treated surface water deliveries to 60 mgd. The Phase 2 project is currently under construction and is expected to be operational by 2015.

5.6.6 Wastewater Planning Efforts

In addition to the development of agency-specific Wastewater Master Plans, regional coordination for wastewater-related efforts has been completed by entities within the Region, helping lay the foundation for IRWM planning in the Region. Examples of these efforts include:

- *The Turlock Regional Water Quality Control Facility (RWQCF).* The Turlock Regional Water Quality Control provides tertiary treatment of wastewater from the City of Turlock and the community service districts of Keyes and Denair. Furthermore, the Turlock RWQCF processes one million gallons per day of wastewater from the City of Ceres (approximately 30% of Ceres' total flow); this wastewater is partially treated before being sent to Turlock. Ceres has purchased the rights to discharge an additional 1 mgd of wastewater to Turlock, and the pipeline from Ceres to Turlock has a total hydraulic capacity of 6.5 mgd to allow for further regionalization efforts. Operation of these facilities requires on-going communication and coordination.
- *Wastewater Regionalization.* In November 2010, Erler & Kalinowski, Inc. (EKI) completed an evaluation of the feasibility of forming a regional system to provide wastewater services to the Cities of Modesto, Ceres, and/or Turlock. The study area consisted of the Cities of Modesto, Ceres, and Turlock. The study identified and evaluated options for wastewater regionalization in the study area and evaluated the feasibility of these options on a technical, economic, and legal basis. The study found that there are significant operational efficiencies to be realized by combining wastewater treatment and disposal systems in the study area. According to a conceptual-level cost evaluation, the potential combined savings across all three cities on a 30-year present worth basis appear to be in the ballpark of $100 million. The cities will continue to coordinate on the potential for wastewater regionalization.
- *North Valley Regional Recycled Water Program (NVRRWP).* This is a proposed recycled water project to deliver up to 30,930 AFY of tertiary-treated recycled water to the drought-impacted west side of Stanislaus County, primarily the Del Puerto Water District and other potential users. The recycled water will be used for agricultural irrigation. This quantity of water would be available from the combined Cities of Modesto, Turlock, and Ceres effluents and could irrigate 15,600 acres of land per year (at two acre-feet per acre of applied water). An additional 15,682 acre-feet per year of recycled water will be made available once the City of Modesto upgrades its secondary-treated wastewater treatment plant to tertiary levels. At the above-described build-out scenario, a total of 46,900 acre-feet per year of recycled water would be available for unrestricted farmland irrigation. The cities are coordinating with Del Puerto Water District to determine project feasibility.

- *Recycled Water Expansion*. As noted in their 2010 UWMP, the City of Modesto currently recycles some of its effluent for agricultural irrigation and is currently evaluating expansion of recycled water use in the future (West Yost Associates, 2011b). The City of Patterson has expressed interest in participating in Modesto's program when recycled water becomes available and may also seek to send its wastewater to Modesto for full or tertiary treatment and have the recycled water returned for use in its non-potable system (The H2O Group, 2012).

5.7 Relation to Local Flood Control Planning

There are existing flood management planning activities underway in the East Stanislaus Region that are contributing to development of the East Stanislaus IRWMP. Two significant efforts include the DWR's Regional Flood Management Planning Initiative's Central Valley Flood Protection Plan, as well as the Mid-San Joaquin River Regional Flood Management Plan. The goal of DWR's Regional Flood Management Planning Program is to build upon flood risk management information developed through, and contained in the Central Valley Flood Protection Plan and to develop a long-term vision for "a flood safe region" through the use of detailed regional information and a collaborative local planning process. Integrated Flood Management is an approach to dealing with flood risk that recognizes the:

- interconnectedness of flood management actions within broader water resources management and land use planning,
- value of coordinating across geographic and agency boundaries,
- need to evaluate opportunities and potential impacts from a system perspective, and
- importance of environmental stewardship and sustainability.

The Mid-San Joaquin River Region will support DWR's FloodSAFE initiative through demonstration of integrated multi-benefit flood management projects, coordination with adjacent flood management planning regions, and develop a region-wide flood management solution. A Regional Flood Management Plan will be developed for the Mid-San Joaquin River Region by participating agencies including the Reclamation District (RD) 2092 and Stanislaus County. The East Stanislaus IRWMP participating entities will be active participants in the development of this Flood Management Plan, providing close coordination and integration among the IRWMP and flood management in the Region.

Separately, the Cities of Modesto and Turlock, Stanislaus County, and the TID jointly fund, and work cooperatively on the operation of Gomes Lake, a flood control facility on the San Joaquin River. The Gomes Lake Pumping Plant is approximately 3.5 miles east of the San Joaquin River. The Gomes Lake Pumping Plant pumps backed up water over levees that were constructed in the 1950s and 1960s to preventing stormwater from draining into the San Joaquin River. The water is then discharged into the San Joaquin River (ESA, 2013).

5.8 Relation to Local Land Use Planning

Land use planning entities in the East Stanislaus Region consist of Stanislaus County, Merced County, the incorporated cities of Modesto, Turlock, Ceres, Hughson, Oakdale, Riverbank, Waterford, the Stanislaus Local Agency Formation Commission (LAFCo), and the Stanislaus Council of Governments (StanCOG). Stanislaus County LAFCo develops and updates spheres of influence for cities and districts, prepares Municipal

> IRWM Plans must document:
> - Current relationship between local land use planning, regional water issues, and water management objectives.
> - Future plans to further a collaborative, proactive relationship between land use planners and water managers.
>
> - *Proposition 84 & 1E IRWM Guidelines*, November 2012, Page 22

Service Reviews (MSRs), and works cooperatively with public and private agencies and interests on growth, preservation and service delivery. StanCOG is the Metropolitan Planning Organization (MPO) for the Stanislaus Region as designated by the Federal government. It is a council of city and county governments comprised of the Cities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock and Waterford and Stanislaus County. The water management entities within the Region include Stanislaus County, Merced County, the cities of Modesto, Turlock, Ceres, Hughson, Oakdale, Riverbank, MID, TID, and OID, various community service districts, as well as the Army Corps of Engineers and state entities. Many of the water management entities in the Region are also land use planning entities and therefore, coordinate internally. Indirect coordination is conducted through completion of master plans, General Plans, UWMPs, and other land use or water plans in which water managers can provide input regarding project or land use decisions that may impact water supply or water quality and vice versa.

The relationship between the cities and the irrigation districts in Stanislaus County is very good, however, it is recognized that coordination between water managers and land use entities could always be improved; it is the intent of the East Stanislaus IRWM planning process to strengthen coordination among all water and land use planning entities in the Region. Because the East Stanislaus Region overlies a significant portion of Stanislaus County, the County is being encouraged to participate in the IRWM planning effort. Targeted outreach to County representatives has, and will continue to be, conducted in the future.

Stanislaus County, and the Cities of Ceres, Hughson, Modesto, Oakdale, Riverbank, Turlock, Waterford, as well as Newman and Patterson (both of which are just outside of the East Stanislaus Region), prepared and submitted a joint funding request to the California Strategic Growth Council for the Stanislaus County Regional Sustainability Toolbox. The Toolbox will include the development of multiple planning tools to achieve greenhouse gas reductions in the region, comprised of eleven components. For example, Water Efficient Landscape Guidelines and Standards will be developed, as well as Low Impact Developments Standards and Specifications. Some of these components are related to land use planning and because many of the same entities were involved in development of the Toolbox, this will be an opportunity to coordinate on water planning and land use planning efforts. It is recognized by participating agencies that there are opportunities for improved coordination among water planners and land use planners. Allowing for early water management input and coordination with those responsible for making land use decisions and implementing land use changes will improve not only land use planning, but also water resources planning.

Chapter 6 The Projects

This chapter discusses:

- The process used to solicit projects for the IRWM Plan;
- How the projects were reviewed for consistency with IRWMP objectives;
- How the projects were evaluated with respects to integration; and
- How the projects were prioritized.

The results of these activities are included in Appendices I through P of this plan.

Finally, this chapter also includes the potential impact and benefits of implementing this IRWMP and the projects identified within it.

6.1 Project Solicitation

Project solicitation is the process by which agencies, organizations, and/or members of the public can submit project concepts for inclusion in the IRWMP. To be considered for the IRWMP, projects must be described in sufficient detail to identify the need being met, infrastructure to be constructed and operated, tasks to be implemented, and the impacts and benefits of the project. However, the projects can be in any stage of development, from conceptual to final design. There are many benefits to submitting a project for inclusion in the IRWMP, including raising local awareness of the potential project and its associated benefits, identification of potential project improvements and/or integration, and positioning the project for potential State funding.

In order to facilitate project solicitation, a project information form, reviewed and approved by the Steering Committee (SC) and Public Advisory Committee (PAC), was prepared (see Appendix I for a copy of the form). Additionally, the OPTI system for online project submittal and management was developed and posted on IRWMP website. The OPTI system allows project information to be submitted, reviewed, organized, and regularly updated electronically by the ESRWMP and project proponents. Access to project summaries is available to all interested parties with the intention of improving IRWMP transparency.

The IRWMP must contain a process or processes to select projects for inclusion in the IRWM Plan. The selection process must include the following components:

- Procedures for submitting a project to the RWMG.
- Procedures for review of projects considered for inclusion in to the IRWMP. These procedures must, at a minimum, consider the following factors:
  - Plan objectives
  - RMS
  - Technical feasibility
  - DACs & EJ considerations
  - Project cost/financing
  - Economic feasibility
  - Project status
  - Strategic considerations for IRWMP implementation
  - Climate change & GHG emissions
  - Plan adoption
  - Reducing dependence on the Sacramento-San Joaquin Delta
- A list of the selected projects.

- *Proposition 84 & 1E IRWM Guidelines*, July 2012, Pages 19 & 20

A public meeting was held on April 12, 2012 to announce the project solicitation and to review OPTI and the ways the project proponents could submit projects. This meeting was formally noticed and flyers were distributed. Each project proponent was instructed to provide, at a minimum, basic information about their project, including a project description, contribution to IRWM objectives, water-related benefits, estimated costs, project status and details. It was established that projects could be submitted by anyone, and could have a single proponent or multiple proponents.

The project information form (along with subsequent discussion at the public meeting) explained that projects submitted for consideration would be separated into three categories: Concept Projects, Preliminary Design Complete, and Ready-to-Proceed (RTP) Projects. RTP Projects consist of projects that are ready or close to being ready for implementation. They could be construction projects, research projects, or studies, but must be developed enough to have detailed budget and schedule information available and most planning, design and environmental documentation (if required) completed. Concept Projects are projects that are at a conceptual level and require additional project development before being implementation-ready. Preliminary Design Complete Projects are further developed than the Concept Projects, but may not yet ready for implementation. Concept Projects, Preliminary Design Complete projects, and RTP Projects would be included in the IRWMP, but Concept Projects would not be considered for inclusion in applications for funding through DWRs IRWM Grant Program.

The East Stanislaus IRWM Region's first project solicitation period was held from April 2 2012 to May 7, 2012. The solicitation period was subsequently extended until June 10, 2012 at the request of project proponents, stating the need more time to become familiar with the OPTI system. (It should be noted that project proponents also had the option of mailing a hard-copy project solicitation form in lieu of OPTI submittal.) During this solicitation period, 27 projects were submitted, of which 10 were Concept Projects and 17 were either Preliminary Design Complete Projects or RTP Projects (see Appendix J for a summary of projects submitted).

In order to facilitate review and organization of the project submittals, the IRWM project website provides the option of printing or exporting a detailed list of all projects submitted. The ESRWMP used this project list in discussions regarding submitted projects with the SC members, PAC members and other stakeholders. The online project database is open at all times for receipt of new projects as well as for editing and revision of currently submitted projects. As new funding opportunities arise, the ESRWMP will issue a new "Call for Projects" with a deadline appropriate for that funding application. See Chapter 8, Plan Implementation, for more information regarding the frequency of project solicitation.

6.2 Project Review and Integration

A project review process was created for determining whether or not the submitted projects would be included in the IRWM Plan. A subcommittee of SC and PAC members was established to review the submitted projects for consistency with the IRWM program (as defined by DWR's Guidelines), confirm independent utility, and to look for opportunities for integration and enhancement. The subcommittee was composed of volunteer members from the East Stanislaus Region, but excluded personnel who represented an agency who had submitted a project (project proponents) for inclusion in the ESIRWMP.

> The IRWMP must contain structure and processes that provide opportunities to develop and foster integration.
>
> - *Proposition 84 & 1E IRWM Guidelines*, July 2012, Page 19

The Project Review Subcommittee met on July 26, 2012 to review the projects per the previously mentioned objectives. To be considered for inclusion in the East Stanislaus IRWM Plan, a project was required to fulfill five minimum requirements. Specifically, the project had to:

- Be located at least partially within the East Stanislaus IRWM region;
- Meet at least one Regional objective;
- Fulfill at least one Resource Management Strategy;
- Fulfill at least one Statewide Strategy; and
- Be technically feasible.

Based on the subcommittee's review, all projects submitted during the first call for projects met the minimum requirements. The projects were then evaluated for independent utility and to identify opportunities for integration and/or enhancement. While all projects met the IRWM program's goals, two projects ("Well No. 9 Arsenic Treatment Facility" and "Well No. 9) had overlapping scopes of work and were considered to be interdependent. Due to this lack of independent utility, the Project Review Subcommittee recommended to the projects' proponent (the City of Hughson in both cases) that the projects be combined.

The Subcommittee also made recommendations for integration and/or enhancements to the projects to increase the degree of benefits provided by the projects. For example, the Subcommittee recommended use of renewable energy sources (e.g. solar panels) to offset energy use at the proposed Regional Surface Water Treatment Plant. Recommendations were transmitted back to project proponents, and the project proponents had an opportunity to update the project information was provided.

6.3 Project Prioritization

A project prioritization process developed by PAC, and was subsequently approved by SC, in order to rank and compare the Preliminary Design Complete, and RTP Projects. The project prioritization process was not conducted for Conceptual Projects.

The project prioritization process implemented a two-step approach. The first step considered regional goals and objectives, statewide priorities and other relevant factors such as benefit-cost (B/C) ratio and multiple benefits. The second step qualitatively considered the relative greenhouse gas (GHG) emissions of the project.

6.3.1 Prioritization Process Development

As part of the development of the project solicitation and prioritization process, the PAC developed a process for prioritization the projects submitted for inclusion in the East Stanislaus IRWMP. This process was reviewed by the SC with recommendations made back to the PAC. Following subsequent changes to the prioritization process, both committees approved the prioritization process. The following describes the approved project prioritization process.

6.3.1.1 Project Prioritization Step 1 – Project Ranking with Respect to Regional Goals, Statewide Priorities and other Relevant Factors

In discussing various models for project prioritization, a two-step program was selected for implementation in the ESIRWM region. The first step of project prioritization process considered the projects relative to regional goals and objectives, statewide priorities and other relevant factors such as benefit-cost (B/C) ratio and multiple benefits. Specifically, the regional IRWM planning participants felt that the Region's goals, and therefore the associated objectives, should be the mostly influential factor in the project prioritization process in order to identify those projects that, when implemented, would best help the Region achieve its vision for regional water resource management. The planning participants also felt the achieving the Statewide Priorities, addressing other project aspects (such as readiness to proceed) and project feasibility also merited consideration in project ranking. The Step 1 project prioritization process as developed thus reflects this thinking. A weighting scoring system was selected as the means of ensuring that the process results reflect the intent of the prioritization. The SC and PAC applied weighting factors to the scoring criteria which included the categories of Regional Objectives, Statewide Priorities, Other Strategies, and Feasibility. This weighting schema allows for flexibility for future changes to the prioritized objectives as regional water resources issues change over time.

With the Region's vision in mind, the Regional Objectives account for half of the total weight applied in the project scoring system. Within that half of the total weight, the goals were then weighted individually. The committees agreed that water supply, flood protection, and water quality are major issues that need to be addressed, as demonstrated by each category accounting for 10% of a project's score. Environmental protection and enhancement, and regional communication and cooperation were each to account for 7% of a project's score, and while lastly, but still importantly, economic and social responsibility accounts for 6% of a project's score. The remaining 50% of the scoring weights were then distributed amongst Statewide Priorities (worth 25% of the remaining weights, with other strategies and project feasibility accounting for 16% and 9% of the weights, respectively. The distributed weights were multiplied by a project score in each category, ranging from 0 to 5 based on its applicability to the project and the magnitude to which the project achieved each objective. A copy of the final project prioritization scoring sheet is included in Appendix K.

In developing scoring weights for the Statewide Priorities, the SC and PAC chose to assign greater weights to those priorities that best supported the 'more important' Regional goals of water supply, flood protection and water quality. Similarly, the SC and PAC determined that other factors, not directly incorporated into either the Regional goals and objectives or Statewide Priorities, should be considered and weighted as part of the prioritization process. Other Strategies, as defined by the SC and PAC in the context of the project prioritization process, included direct benefits to DACs and tribal communities, schedule (i.e. readiness to proceed), whether a project was an inter-regional project and therefore taking advantage of a larger scale of benefits, and/or whether a project provided non-water related benefits such as new jobs in the Region. Finally, the feasibility of a project from the standpoint of costs and benefits was also considered an important factor. Projects were scored based on an indirect benefit-cost analysis conducted on each project and based on the degree to which project financing was available.

The benefit-cost analysis was conducted on all non-Concept projects submitted for inclusion in the IRWM process. The analysis was a semi-numerical analysis designed to rank projects relative to their costs and benefits achieved given, in some cases, relatively gross data. In this analysis, project costs included capital costs, annual O&M costs (assuming 10% of capital costs when O&M costs were not supplied), and the cost of items to be replaced during the life of the project. Project life was assigned either given information provided by the project proponent or selected from a list of pre-defined life spans for various water infrastructure, as developed from a list of publically-available resources. This list of infrastructure life spans is included in Appendix M. The present value cost of the project was then calculated in 2012 dollars, assuming a 6% discount factor (for consistency with DWR guidelines), as follows:

$$Present\ Value\ Cost = Capital\ Cost + O\&M\ Cost * \sum_{0}^{n} PV\ Factor$$

where n is the project life and the PV factor is defined as:

$$PV\ Factor = 1/[(1+i)^n)]$$

where i is the discount factor.

Cost scores were then assigned a measure of 'high' or 1 point if the project's present value cost was less than $2 million, a measure of 'medium' or 2 points if the present value cost was between $2 million and $20 million, and a measure of 'low' or 3 points if the present value cost was greater than $20 million. Project benefits were similarly given high, medium or low rankings based on the number of objectives achieved. A project received a ranking of 'high' or 3 points if it achieved greater than 8 objectives, a ranking of 'medium' or 2 points if it achieved between 4 and 8 objectives, and a ranking of 'low' or 1 point if it achieved less than 4 objectives. Project scores for benefits and costs were then used to calculate a benefit-cost (B/C) ratio for each project, and were then ranked either 'high' if the B/C ratio was greater than 2, 'medium' of the B/C ratio was ranked between 1 and 2, or 'low' if the B/C ratio was between 0 and 1. These high, medium, and low rankings were then assumed point scores of 5, 3 and 1, respectively, with the scores entered into the appropriate line on the project prioritization scoring sheet. A summary of the benefit-cost analyses conducted on the submitted projects is included in Appendix N.

The resulting percentages applied to the various project scoring criteria are summarized below. Projects were subsequently ranked as high, medium or low priority based on their score resulting from application of this prioritization process.

6.3.1.2 Project Prioritization Step 2 – Qualitative Comparison of Project GHG Impacts

As directed by the Guidelines, greenhouse gas (GHG) emissions were considered by the IRWM Region in development of the project prioritization process. After discussions, the Region decided to include GHG impacts and emissions as a secondary criteria (or second step) in developing project rankings. As with the primary (Step 1) prioritization process, only non-Concept projects were evaluated in this Step 2 process.

In developing the Step 2 prioritization process, it was acknowledged that a quantitative calculation of each project's GHG emissions would, most likely, not be available from the project proponent, nor was it in the wherewithal of either the SC or PAC to prepare such calculations. Therefore, a qualitative comparative methodology was developed and applied to the projects. Additionally, it was acknowledged that these quantitative GHG emissions calculations are required as part of the California Environmental Quality Act (CEQA) process and therefore would, for the most part, be available during the grant application process and/or prior to project implementation.

A GHG emissions score sheet was developed by the SC and PAC for use in preparing this secondary evaluation (see Appendix L). Key to the application of this score sheet is the assumption that <u>all</u> projects would require construction and would therefore result in construction-related GHG emissions. Any project that did not require construction (e.g. a paper study) would receive a 'benefit' as a result of no construction. Projects impacts and benefits relative to GHG emissions were then evaluated based on a series of yes/no questions.

Table 6-1: Project Prioritization Process Weights

Prioritization Factor	Weighting	Comments
Regional Objectives	**50%**	
Water Supply	10%	With the Region's vision in mind, the Regional Objectives account for half of the total weight. Within that half of the total weight, the goals were then weighted individually with greater importance placed on reaching the Region's water supply, flood protection, and water quality goals.
Flood Protection	10%	
Water Quality	10%	
Environmental Protection and Enhancement	7%	
Regional Communication and Cooperation	7%	
Economic and Social Responsibility	6%	
Statewide Priorities	**25%**	
Drought Preparedness	5%	Achieving Statewide Priorities was considered an achievement only secondary to achieving the Region's goals and objectives. Statewide priorities that also support the Region's primary goals with respects to water supply, flood protection and water quality were given greater weights.
Use and Reuse Water More Efficiently	5%	
Climate Change Response/Adaptation Actions	3%	
Expand Environmental Stewardship	2%	
Practice Integrated Flood Management	3%	
Protect Surface Water and Groundwater Quality	3%	
Improve Tribal Water and Natural Resources	2%	
Ensure Equitable Distribution of Benefits; Provide Environmental Justice	2%	
Other Strategies	**16%**	
Direct Benefit to DAC and/or Native American Communities	4%	Other Strategies were intended to reflect the criteria considered important in project prioritization but not covered/reflected in either Regional goals or objectives or Statewide Priorities.
Schedule	8%	
Inter-Regional Project	2%	
Provide Non-Water Related Benefits	2%	
Feasibility	**9%**	
Benefit-Cost Analysis	6%	The feasibility criteria focused on the cost-effectiveness of the projects (relative to the benefits achieved) and the financial 'security' of the project.
Financing/Economic Feasibility	3%	

Within each prioritization category resulting from application of the Step 1 prioritization process, projects were ordered/ranked based on their relative impacts or mitigation/benefits (or neutrality). The resulting project prioritization therefore reflected the ability of the project to achieve the Region's goals and objectives, Statewide Priorities or important criteria, while providing a secondary prioritization based on GHG emissions, benefits and/or mitigations.

6.3.2 Prioritization Application and Results

The project prioritization process described above was implemented on the projects received for inclusion in the East Stanislaus IRWMP. Information used in evaluating the submitted projects against the prioritized criteria were provided via the project submittal process, as previously described. As previously noted, the Project Review Subcommittee met on July 26, 2012 and applied the scoring criteria (both primary and secondary) to the projects submitted. The results of this prioritization process are included in Appendix P for the primary and secondary scoring process, respectively.

6.4 Impacts and Benefits

> The IRWMP must contain a discussion of potential impacts and benefits of Plan implementation. This discussion must include both impacts and benefits within the IRWM region, between regions, and those directly affecting DACs, EJ concerns, and Native American Tribal communities.
>
> - *Proposition 84 & 1E IRWM Guidelines*, July 2012, Page 20

The East Stanislaus IRWM partners and stakeholders recognize the importance of pursuing and integrating multiple resource management strategies to achieve the greatest and most equitable benefit for the region. Through implementation of this IRWM Plan, regional and localized benefits will be realized and potential impacts addressed. This section provides an overview of potential benefits and impacts that may result from implementation of projects or programs included in the East Stanislaus IRWM Plan.

It should be noted that inclusion of a project in this IRWM Plan indicates that it passed the screening requirements outlined in Sections 6.2 and 6.3, but does not necessarily reflect endorsement by the PAC. In addition, inclusion of a project in the IRWM Plan does not commit the ESRWMP or PAC member(s) to implement the project. Implementation, if undertaken, is the responsibility of the project proponent. Prior to implementation and/or construction of any project included in this Plan, individual environmental review, compliant with CEQA, the National Environmental Policy Act (NEPA), and any other local, state and/or federal requirements as applicable, will be completed by the project proponents.

The potential impacts and benefits that implementing the projects included in the East Stanislaus IRWM Plan could achieve are shown in Table 6-2, and are described in more detail in the following sections. A table cross-referencing the submitted projects with the project types noted below is included in Appendix O.

Table 6-2: Potential Impacts and Benefits by Project Type

Project Type	Within the East Stanislaus Region		Interregional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Groundwater Projects				
Groundwater Supply Development	Water quality degradation Reduced groundwater availability and reliability	Increased groundwater storage / recharge Improved water supply reliability Improved water quality Reduced land subsidence and/or fissuring Local prosperity	Water quality degradation Reduced groundwater availability and reliability	Increased groundwater storage/recharge Improved water supply reliability Improved water quality Local prosperity
Conjunctive Use	Water quality degradation Reduced groundwater availability and reliability	Increased groundwater storage / recharge Improved water supply reliability Improved water quality Reduced land subsidence and/or fissuring Improved water management coordination Local prosperity	Water quality degradation Reduced groundwater availability and reliability	Increased groundwater storage/recharge Improved water supply reliability Improved water quality Reduced land subsidence and/or fissuring Improved water management coordination Local prosperity
Potable Water Supply Projects				
Conveyance Facilities	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability	None	None
Storage Facilities or Storage Operations	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water quality (through reduced groundwater pumping) Improved water supply reliability	None	Improved water quality (through reduced groundwater pumping)
Treatment Facilities	Energy consumption Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability Improved water quality Economic benefits	None	None
Salinity Management	None	Improved water quality Long-term sustainability of water supplies Local prosperity	None	Improved water quality Long-term sustainability of water supplies Local prosperity
Conservation Projects				
Outreach and Education	Reduced discharges to Tuolumne, Stanislaus and Merced Rivers	Improved water supply reliability Public education and environmental awareness	Reduced discharges to Tuolumne, Stanislaus and Merced Rivers	Improved water supply reliability Public education and environmental awareness
Economic Incentives	Reduced discharges to Tuolumne, Stanislaus and Merced Rivers	Improved water supply reliability Avoided costs of imported water supply Avoided costs of water supply infrastructure Local prosperity	Reduced discharges to Tuolumne, Stanislaus and Merced Rivers	Improved water supply reliability Avoided costs of imported water supply Avoided costs of water supply infrastructure Local prosperity
Wastewater Projects				
Conveyance Facilities	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability	None	None
Treatment Facilities	Energy consumption Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability Improved water quality Avoided costs of imported water supply Local prosperity	None	Improved water quality
Septic to Sewer Conversion	Land use compatibility (rights-of-way) Disturbance of habitat and endangered	Improved water quality Local prosperity	None	None

Project Type	Within the East Stanislaus Region		Interregional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
	species			
Recycled/Non-Potable Water Projects				
Conveyance Facilities	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species Water quality degradation	Improved water supply reliability Increased nutrient levels for landscape irrigation Potable water offsets	None	Improved water supply reliability Potable water offsets
Treatment Facilities	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability Potable water offsets Improved water quality Local prosperity	None	Improved water supply reliability Potable water offsets Improved water quality
Salinity Management	None	Improved water quality Improved water supply reliability Local prosperity	None	Improved water quality Improved water supply reliability Local prosperity
Urban Runoff Management Projects				
Stormwater Capture and Reuse / Recharge	Water quality degradation	Increased groundwater storage / recharge Improved water supply reliability Reduced land subsidence and/or fissuring Avoided costs of imported water supply Local prosperity	Water quality degradation	Increased groundwater storage / recharge Improved water supply reliability Avoided costs of imported water supply Local prosperity
Diversion to Sewer	Disturbance of habitat and endangered species	Improved water quality Flood control enhancement Increased recycled water	None	None
Pollution Prevention	None	Improved water quality	None	Improved water quality
Flood Management Projects				
Storm Drains or Channels	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species Increased sedimentation and erosion Economic impacts	Flood control enhancement Increased groundwater storage / recharge Avoided costs of flood damage Local prosperity	None	None
Ecosystem Restoration and Protection Projects				
Land Conservation	Economic impacts	Improved water quality Flood control enhancement Habitat protection, restoration, and enhancement Open space preservation	None	None
Invasive Species Removal	Disturbance of habitat and endangered species Increased sedimentation and erosion	Improved water quality Flood control enhancement Habitat protection, restoration, and enhancement	None	None
Restoration / Revegetation	Disturbance of habitat and endangered species	Improved water quality Flood control enhancement Habitat protection, restoration and enhancement Reduced threat of wildfires	None	None
Water-Based Recreation Projects				
Reservoir Recreation	Water quality degradation	Enhanced recreation and public access	None	None

Project Type	Within the East Stanislaus Region		Interregional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Parks, Access and Trails	Disturbance of habitat and endangered species Increased sedimentation and erosion	Local prosperity Enhanced recreation and public access Local prosperity	None	None
Data Collection/Management Project				
Data Collection and Management	None	Improved data accessibility and dissemination Public access to data Facilitation of projects	None	Improved data accessibility and dissemination Public access to data Facilitation of projects
Outreach Project				
Outreach	None	Improved intraregional coordination and communication Identification of collaboration opportunities Identification of potential project enhancements	None	Improved inter-regional coordination and communication Identification of collaboration opportunities Identification of potential project enhancements
Public Education	None	Increased public awareness and support of IRWM-related projects Improved consumer response to water resource management requests	None	Increased public awareness and support of IRWM-related projects Improved consumer response to water resource management requests
DAC Support	None	Improved accessibility to regional support for project design and implementation Identification and facilitation of projects that directly improve water supply reliability and water quality for DACs	None	Improved accessibility to regional support for project design and implementation Identification and facilitation of projects that directly improve water supply reliability and water quality for DACs

6.4.1 Plan Implementation Benefits and Impacts

6.4.1.1 Regional Impacts and Benefits

Implementation of East Stanislaus IRWM Plan will lead to numerous benefits including, at a minimum:

- **A more reliable and high quality water supply.** Additional water supplies and conjunctive use lead to enhanced water supply reliability and assist with the improvement of water quality. Water quality projects ensure that existing water quality is sustained and protected. Reliable and high quality water is directly linked to economic and environmental health and well-being.

- **Cost-effective and multi-beneficial projects.** Opportunities for multi-benefit projects, which can achieve a multitude of goals and objectives for several stakeholders rather than a single entity, provide increased value to stakeholders and the communities they serve. Integrated planning and collaboration can lead to multi-benefit projects that achieve cost savings through cost-sharing opportunities, economies of scale, resource sharing, and other mechanisms. Existing resources can be optimized, duplication of efforts avoided, and larger scale efforts developed to provide cost savings to all involved.

- **Shared experience and resources.** Completion of the East Stanislaus IRWM Plan and implementation of the Plan facilitates knowledge sharing and equips agencies to overcome future challenges by coordinating resources, more effectively meeting the needs of the region as a whole. In addition to direct quantitative benefits of Plan implementation, such as new or more reliable water supplies, indirect benefits are expected to result from avoiding the negative impacts of not implementing the projects.

- **Increased regional understanding.** Agencies and stakeholders are working together as a cohesive group to solve water resource problems in a consensus-based approach, resulting in a deeper understanding of the effects of each individual project on other agencies and stakeholders. This deeper understanding, in turn, reduces interagency conflicts that may prevent projects from gaining the necessary support for successful implementation.

- **Improved local understanding of water resources issues.** Through consistent and coordinated public outreach and education programs, local understanding of regional water resources issues, conflicts, and solutions will improve. Maintaining a consistent message will improve public understanding of water resource management issues and encourage the acceptance and understanding of integrated projects.

Potential impacts of implementation of the East Stanislaus IRWM Plan could include a variety of temporary construction-related impacts during project construction, including dust, noise, and traffic generation. Other impacts may include increased costs associated with water infrastructure financing. Additional impacts may be identified on a project-by-project basis during CEQA or NEPA analyses.

Conversely, should the East Stanislaus IRWMP not be implemented, the impacts to the region, water and wastewater agencies, and residents within it would be vast. The same issues the region is currently experiencing would not be resolved and while individual, localized planning efforts and projects would likely continue, they would not achieve the same magnitude and multitude of benefits delivered from regional planning and implementation.

6.4.1.2 Interregional Benefits and Impacts

Interregional projects such as the North Valley Regional Recycled Water Project stand to provide benefits that extend beyond regional boundaries. The projects included in this Plan benefit not only the local agencies and residents of the East Stanislaus Region, but multiple watersheds (Stanislaus, Tuolumne and Merced River watersheds), the Delta, and members of the public throughout California. Specific ways in which the projects contained in the East Stanislaus IRWM Plan provide benefits beyond the East Stanislaus region include the following:

- Reduced effluent discharges (and associated pollutant loadings) into the Tuolumne River due to increased recycled water use, promoting improved water quality both in the Tuolumne and San Joaquin Rivers and downstream in the Delta.

- Improved regional water supply and reliability for Stanislaus County, achieved through several water storage projects, will reduce pressure on the Delta and on the Modesto and Turlock Groundwater Subbasins to serve the region in times of significant drought. Additional wastewater reuse projects will also reduce the demand for potable water, potentially increasing downstream supplies.

- Conjunctive use projects will increase water supply reliability within the region, resulting in increased surface water supply availability in dry years and reduced pressure on the San Joaquin River as a water supply.

Most likely, project-dependent construction-related impacts would not impact other IRWM regions, as project and program facilities would be implemented within the East Stanislaus Region. These construction impacts would be temporary in nature and will result in predominantly local impacts, if any.

The East Stanislaus IRWM Plan also has the potential to benefit resources beyond local and regional water resources. Improved surface water quality will benefit local ecosystems. Enhanced tree cover, while viewed as a habitat enhancement, may also directly benefit regional air quality through the creation of microclimates and the filtering capacity provided by trees. By optimizing water supply operations and implementing conjunctive use, additional surface water supplies may be available for hydropower generation to benefit statewide energy resources and for the proposed San Joaquin River Wildlife Refuge expansion.

6.4.1.3 Benefits and Impacts to DACs and EJ-Related Concerns

Protection of the people and economy of disadvantaged communities (DACs) and correction of environmental justice concerns are priorities for the East Stanislaus IRWM Plan. (Please note, there are no federally- or state-recognized Native American communities in the East Stanislaus Region.) Environmental justice is addressed by ensuring that all stakeholders have access to the IRWM planning decision-making process and that minority and/or low-income populations do not bear disproportionately high and adverse human health or environmental impacts. Working on a regional basis aids in protecting the economy of the East Stanislaus Region and Stanislaus County, and minimizes direct monetary impacts felt by DACs in the region through the stabilization of water and wastewater utility rates. Implementation of the Region's flood control projects will protect the local communities from disastrous flood damage. Regional coordination has been, and will continue to be, achieved through the noticing of public meetings, to be held as needed to address public and stakeholder concerns, conducting routine reviews to ensure that DACs are not being adversely affected by project and Plan implementation, and by using grant monies receive to help offset project implementation costs.

Impacts to DACs will be kept to a minimum, and ongoing coordination and public involvement will aid in preventing possible impacts. Construction of project facilities will create short-term environmental impacts (noise, dust, traffic disruption) at neighboring communities. A preliminary analysis of the areas affected by construction of project facilities will ensure that these construction nuisance impacts will not be borne predominantly by any minority population or low-income group.

6.4.2 Project/Program Impacts and Benefits

The potential benefits and impacts summarized in Table 6-2 are described in more detail in the following sections. Additionally, the projects included in the East Stanislaus IRWMP, by project type, are summarized in the table included in Appendix J. For each project, potential benefits and impacts are assumed to be similar to those identified for the specific project type.

6.4.2.1 Benefits

Increased groundwater storage / recharge

The Modesto and Turlock Subbasins of the San Joaquin Valley Groundwater Basin underlie most of Stanislaus County. Use of groundwater for irrigation and municipal purposes has resulted in historical declines of available groundwater in previous years. In past years, both subbasins have experienced overdraft conditions, with groundwater depressions underlying the cities of Modesto and Turlock. A cone of depression has also formed on the eastern side of the Turlock Subbasin where groundwater is the only available water supply. Groundwater recharge could help improve the state of the subbasins and their long-term sustainability. Groundwater improvement programs may include projects to:

- Enhance conjunctive management and groundwater storage
- Aquifer storage and recovery
- Stormwater capture and recharge
- Construction of new and/or rehabilitation of spreading grounds/recharge basins
- Improvement to groundwater monitoring
- Hydrogeologic investigations and groundwater modeling

Improved water supply reliability

Improving water supply reliability in the East Stanislaus Region is a key objective of the Region's water supply goal. Projects that diversify the Region's water supply portfolio, create new supplies, improve efficiencies of existing supplies, or offset potable water supplies will improve the Region's water supply reliability. Projects that would achieve this benefit include:

- Water use efficiency and water management projects
- New water supply pipelines and/or rehabilitation/repair projects
- Water system tie-ins, interconnections, and diversion structures
- Water transfer projects
- Groundwater extraction and/or treatment projects
- Surface water diversion and treatment projects

- Water storage and treatment projects
- Upgrading wastewater treatment facilities to produce recycled water
- Water quality protection projects

Improved water quality

As described in Chapter 5, Vision, Goals, and Objectives, protecting and improving water quality for beneficial uses consistent with regional interests and the RWQCB Basin Plan is a key regional goal. Different types of projects contribute to different types of water quality improvements. For example, groundwater recharge projects can improve groundwater quality in the Modesto groundwater subbasin, while treatment improvement projects will improve potable water quality. Projects that improve water quality include, but are not limited to:

- Stormwater projects (e.g. stormwater capture and recharge or stormwater management to reduce volume of urban runoff discharged to surface waters)
- Upgrading wastewater treatment plants
- Groundwater monitoring and assessment
- Conversion of septic systems to municipal sewers
- Conjunctive management and groundwater storage
- Sewer collection improvements
- Water treatment projects
- Ecosystem restoration and revegetation projects
- Land conservation
- Salinity management

Reduced land subsidence and/or fissuring

Land subsidence occurs when groundwater is excessively pumped from a groundwater basin; the clay layers in the aquifer settle and the ground surface in the area lowers. While subsidence has historically not been a concern in the region, projects that will reduce groundwater pumping or increase groundwater recharge will help reduce the potential for land subsidence and fissuring. These projects include:

- Enhanced conjunctive management and groundwater storage
- Stormwater capture and recharge
- Construction of new and/or rehabilitation of spreading grounds/recharge basins
- Improvement to groundwater monitoring
- Hydrogeologic investigations and groundwater modeling

Local prosperity

Local prosperity and economic benefits can be achieved by:

- Avoiding costs of water supply infrastructure with the implementation of water management and water use efficiency projects
- Avoiding flood damage costs
- Avoiding impacts to the economy (e.g. businesses and agriculture) associated with water supply interruption
- Increased tourism with enhanced recreational opportunities and improved water quality and ecosystems
- Benefits to the regional economy associated with constructing and maintaining proposed IRWM projects

Additionally, as previously stated, working on a regional basis aids in protecting the economy of the East Stanislaus Region and minimizing direct monetary impacts felt by DACs in the region through the stabilization of water and wastewater utility rates. IRWM planning and collaboration can lead to multi-benefit projects that achieve cost savings through cost-sharing opportunities, economies of scale, resource sharing, and other mechanisms. Existing resources can be optimized, duplication of efforts avoided, and larger scale efforts developed to provide cost savings to all involved.

Long-term sustainability of water supplies

Some groundwater basins throughout California contain salts and nutrient levels exceeding water quality objectives established in Water Quality Control Plans (Basin Plans). The high salt and nutrients concentrations could be from natural or man-made. Salinity management is key to ensuring the long-term sustainability of groundwater supplies. Groundwater quality varies throughout the East Stanislaus Region. As new water supplies are developed, recycled water use increases, and groundwater recharge projects are implemented, the importance of salinity management and other water quality management programs will increase.

Public education and environmental awareness

Many water conservation, water quality protection, and water supply projects include public education and environmental awareness components, creating multi-benefit projects or programs. Public outreach programs and components can help promote and increase water efficient management practices, educate about habitat stewardship which can improve water resources, discourage illegal dumping of trash and litter in watercourses, and encourage appropriate water management practices, including appropriate collection and disposal of hazardous liquid wastes and pharmaceuticals.

Increased nutrient levels for landscape irrigation

Depending on the nutrients supplied by the recycled water available, increasing the use of recycled water for landscape irrigation through construction of additional conveyance facilities could significantly reduce the amount of fertilizer required for irrigated areas.

Potable water offsets

Potable water offsets can be achieved through stormwater and recycled water projects. New non-potable water supplies may be used for irrigation or other beneficial uses, helping to increase the region's water supplies. Projects that would provide potable water offsets include:

- Recycled water treatment and conveyance projects
- Stormwater capture and reuse/recharge
- Conversion of septic systems to centralized sewer collection systems to increase the amount of recycled water available

Flood control enhancement

Flooding is a concern for some areas within the East Stanislaus IRWM planning region, especially along the San Joaquin River and the lower Tuolumne River. Flooding can occur from heavy rainfall, rapid snow melt, saturated soils, or a combination of these conditions. In some cases, flooding is due to inadequate storm drainage systems, unable to handle heavy storms during winter and spring seasons, and from increasing development leading to increases in impervious surface areas and decreases in natural vegetative cover, which reduces the detention and attenuation characteristics of the overland areas. To reduce potential property and structure damage, and economic impacts, flood control enhancement may be provided by projects that:

- Capture and divert stormwater
- Improve levee systems (e.g. floodwalls or setback levees)
- Install pervious pavement
- Protection and manage floodplains
- Construct regional flood control infrastructure

Increased recycled water

By centralizing sewer collection systems in areas that may still be on septic, a greater volume of wastewater will be treated at existing and new wastewater treatment facilities, creating more recycled water for beneficial uses. Increasing the amount of recycled water available for farmland, landscape, golf course, and school irrigation, industrial uses, and other uses, will lead to other benefits such as potable water offsets and increased nutrient levels for landscape, as previously discussed.

Habitat protection, restoration, and enhancement

Projects that contribute to habitat protection and restoration have the ability to enhance the Region's ecosystems and protect threatened, endangered, and sensitive species. The following types of projects would provide this benefit:

- Land conservation
- Water quality protection projects that would result in surface water quality improvement
- Invasive species removal
- Restoration and enhancement of special aquatic features (e.g. wetlands, springs, bogs, riverine environments)
- Stormwater management and pollution prevention

- Debris cleanup and habitat restoration
- Meadow restoration
- Forest fuels reduction
- Road management activities to reduce runoff to streams

Reduced threat of wildfire

Wildfires threaten property, lives, and ecosystems, and can adversely impact flood management and erosion. Ecosystem protection and enhancement activities such as forest restoration can help reduce the threat of wildfire. There is already evidence that wildfires are becoming more frequent, longer, and more widespread, and they are expected to increase in frequency and severity due to climate change (CDM, 2011).

Open space preservation

Open space preservation is a benefit that can be achieved through implementation of land conservation projects. Preserving open space contributes to other benefits such as environmental and recreational benefits, as well as stormwater control, reduced runoff, and flood management benefits.

Enhanced recreation and public access

Reservoirs, parks, wildlife refuges and the wilderness within the East Stanislaus Region are used by outdoor recreation enthusiasts throughout the year. Enhancing recreation and public access in the region will be achieved by projects that:

- Conserve and preserve open space and access to public land.
- Remove and control invasive species.
- Improve water quality.
- Provide appropriate sanitation facilities at recreation sites.
- Road management activities to reduce runoff to streams.
- Improve opportunities for public outreach and environmental education.

6.4.2.2 Impacts

Implementation of the projects described in this plan may also have quantitative and/or qualitative impacts if the East Stanislaus IRWM Plan and/or its component projects are not managed or implemented properly. These impacts may include increased project costs to agencies and ratepayers, delayed construction and/or operation of planned facilities leading to delayed water supply and other benefits, negative impacts to surface water and/or groundwater quality, and increasingly limited operational flexibility, especially in times of drought, leading to increased water rationing and associated pressure on water users and the environment.

Project-specific environmental compliance processes will be completed by project proponents prior to project implementation. These processes will determine the significance of project-related impacts. Each project will comply with the CEQA and NEPA requirements, if applicable, prior to and throughout implementation.

Negative impacts that could be associated with the implementation of projects and programs included in this IRWM Plan are similar to those of other water infrastructure projects. In general, temporary, site-specific impacts related to construction and potential long-term impacts associated with project operation are anticipated. Short-term, site-specific construction impacts from implementing physical project facilities may include increased traffic and/or congestion; noise; and impacts to public services, utilities, and aesthetics. Other potential, longer-term impacts are described in more detail below.

Water quality degradation

Groundwater-related projects, such as projects that increase groundwater pumping or implement conjunctive use, could degrade water quality if not operated appropriately for the groundwater basin and conditions. In addition, projects that involve the implementation of potentially contaminating activities in groundwater recharge areas could result in negative impacts to groundwater quality. Surface water quality could be similarly impacted by projects that encourage recreation and/or intensive development by increasing loading of nutrients, bacteria, and other contaminants to adjacent surface water bodies, negatively impacting water quality for water supply and environmental needs.

Recreation-related projects also have the potential to increase erosion and sedimentation. Increased motor vehicle traffic and foot traffic can increase erosion and sedimentation to adjacent water bodies, negatively affecting water quality for water supply and the environment/habitat purposes. Water quality issues associated with increased erosion and sedimentation can be detrimental to aquatic communities. Additionally, storm drains and channel modifications that are implemented to manage flood flows can contribute to erosion and sedimentation. Projects that allow use of motorized watercraft may introduce organic contaminants to water bodies.

Reduced groundwater availability and reliability

There are groundwater quality issues in many areas within the Modesto and Turlock groundwater subbasins. Projects that impact water quality and/or yield could reduce overall groundwater availability and water supply reliability to users depending on the source. Increased groundwater pumping in the subbasins could create overdraft conditions, potentially degrading water quality and further decreasing overall reliability.

Land use compatibility (rights-of-way)

A potential impact of any project that includes construction of physical facilities is land use compatibility. The types of projects that could potentially have land use compatibility or rights-of-way issues include:

- Water conveyance facilities
- Storage tanks or reservoirs
- Treatment plants
- Wastewater collection
- Recycled water distribution facilities

Construction of new facilities outside of disturbed areas, such as roads, could result in disturbance of otherwise undisturbed areas and may result in loss of open space and habitat.

Disturbance of habitat and endangered species

The East Stanislaus Region contains portions of a large wildlife refuge in addition to many riparian habitats. These areas provide habitat for numerous species, including special-status species (i.e. endangered, threatened, sensitive, or candidate). Projects that involve facility construction have the ability to disturb surrounding habitat and endangered species, depending on the location, type of construction, and facilities. All projects implemented will comply with CEQA and NEPA, as applicable, and as part of the process, will identify and implement mitigation measures for potential environmental impacts as necessary.

Energy consumption

The water sector plays a significant role in California's energy consumption. Implementing certain projects may increase energy use. Water and wastewater treatment projects that require significant amounts of power may result in increased energy consumption in the region. Increased energy consumption can increase greenhouse gas emissions, further exacerbating projected climate change impacts.

Reduced discharges to the Tuolumne, Stanislaus and Merced Rivers

Agricultural and urban water use efficiency projects and water recycling projects could reduce the quantity of water discharged to the Tuolumne, Stanislaus and Merced Rivers, effectively reducing streamflows and potentially impacting aquatic habitat.

Economic impacts

Implementation of certain projects may have associated long-term economic impacts to agencies and ratepayers. Project financing has historically provided a challenge in areas of the East Stanislaus Region. Even when grants and/or low-interest loans are available to subsidize project capital costs, agency rate revenues are sometimes insufficient to properly operate and maintain the project. . Because funds available to implementing agencies are generally limited, it will be important to evaluate financing methods and avenues for potential projects prior to implementation such that potential economic impacts on ratepayers and agencies in the Region can be minimized.

Chapter 7 Technical Analysis and Data Management

The Technical Analysis and Data Management section is intended to ensure the efficient and effective use of available data in developing and implementing the East Stanislaus IRWMP, as well as describe stakeholder access to data, and how that data generated by IRWM implementation activities can be integrated into existing State databases.

7.1 Technical Analysis

> The IRWMP must document the data and technical analyses used to develop the IRWMP.
>
> - *Proposition 84 & 1E IRWM Guidelines,* November 2012, Page 22

The East Stanislaus IRWMP has been developed using sound technical information, analyses, and methods. Information, documents, and studies were collected from various sources including the cities of Modesto, Turlock, Ceres, and Hughson, the Central Valley Regional Water Quality Control Board, Stanislaus County, and the California Department of Water Resources. Multiple local water planning and land use documents were reviewed and used to prepare the East Stanislaus IRWMP. These include Urban Water Management Plans (UWMPs), Water Supply Master Plans (WSMPs), project Environmental Impact Reports/Environmental Impact Statements (EIRs/EISs), General Plans and feasibility studies. Additionally, specialized studies, such as those evaluating the potential for future climate change in the Central Valley, were reviewed and used to prepare specific plan sections. Some of the key documents used in the East Stanislaus IRWM planning process are summarized in Table 7-1. All documents cited in the References section of this IRWMP were also reviewed and used in development of the East Stanislaus IRWMP.

Table 7-1: Key Documents Used to Prepare East Stanislaus IRWMP

Document	Year	Author	Description
Modesto Irrigation District Agricultural Water Management Plan for 2012	2012	Modesto Irrigation District	Assesses current efficient water management practices, evaluates additional practices that may conserve water, and presents opportunities for MID to demonstrate existing accomplishments in water use efficiency.
Oakdale Irrigation District Agricultural Water Management Plan	2012	Davids Engineering	Assesses current efficient water management practices, evaluates additional practices that may conserve water, and presents opportunities for OID to demonstrate existing accomplishments in water use efficiency.
Turlock Irrigation District 2012 Agricultural Water Management Plan.	2012	Turlock Irrigation District	Assesses current efficient water management practices, evaluates additional practices that may conserve water, and presents opportunities for TID to demonstrate existing accomplishments in water use efficiency.

Document	Year	Author	Description
Climate Ready Water Utilities Adaptation Strategies Guide for Water Utilities	2012	United States Environmental Protection Agency	Provides strategies to provide water and wastewater utilities with a basic understanding of how climate change can impact utility operations and missions, and examples of actions utilities can take (i.e. adaptive actions) to prepare for these impacts.
Ceres 2010 Urban Water Management Plan	2011	West Yost Associates	Describes current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Ceres.
DWR Disadvantaged Communities GIS data	2011	DWR	DWR derived GIS data at the census block, census tract, and census designated place levels from the U.S. Census Bureau's American Community Survey. Included median household income information for 2006 through 2010.
City of Modesto and Modesto Irrigation District 2010 Joint Urban Water Management Plan	2011	West Yost Associates	Describes current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Modesto and Modesto Irrigation District (MID).
City of Turlock 2010 Urban Water Management Plan	2011	City of Turlock	Describes current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Turlock.
Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada	2010	Null, Sarah E., Joshua H. Viers, and Jeffery F. Mount	Summarizes a study that focused on the differential hydrologic response of individual watersheds (including the Merced, Stanislaus, and Tuolumne River watersheds) to climate change within the Sierra Nevada mountains of California.
2010 Census Data	2010	U.S. Census Bureau	The U.S. Census counts every resident in the U.S. every 10 years, as mandated by the U.S. Constitution, and collects basic information regarding the residents.
Modesto 2010 Water System Engineer's Report	2010	West Yost Associates	Compares the City's existing water supplies with projected water demands to determine if an overall system supply shortage will exist in the future. Includes analysis of the water system's storage, pumping, and pipeline needs, along with the system's ability to meet the operational and design criteria under various demand conditions.
City of Modesto Municipal Stormwater Program, Stormwater Management Plan	2009	City of Modesto	Provides a comprehensive approach to addressing pollutants in stormwater discharges and describes a monitoring program for assessing the health of local water bodies, evaluating selected treatment control

Document	Year	Author	Description
Turlock Groundwater Basin Groundwater Management Plan	2008	Turlock Groundwater Basin Association	Provides an overview of the local agencies, land uses, and status of groundwater resources in the Turlock Groundwater Subbasin, its basin management objectives and the goal of ensuring a safe, reliable, cost-effective groundwater supply for the area and basin .
Modesto Draft Storm Drainage Master Plan	2008	Stantec	Identifies the storm drainage infrastructure improvements needed to effectively accommodate stormwater runoff under existing and future conditions within the City of Modesto's sphere of influence.
Modesto Wastewater Treatment Master Plan and Supplement	2007 and 2008	Carollo Engineers	Guides improvement and expansion of the City of Modesto's wastewater collection, treatment, and disposal facilities and operation with the goal of accommodating the wastewater service needs of the population and land uses as described in the City's General Plan.
City of Modesto Wastewater Collection System Master Plan	2007	Carollo Engineers	Evaluates the City of Modesto's wastewater collection system, existing and future capacity, and identifies recommended improvements to mitigation deficiencies and accommodate growth.
Hughson Wastewater Treatment Master Plan	2007	Carollo Engineers	Consists of a plan for the Hughson Wastewater Treatment Plant based on projected flows and loadings through the year 2025, including evaluations of treatment, effluent, disposal, and biosolids disposal alternatives. Recommends project including an implementation schedule.
Hughson Sewer System Master Plan	2007	Carollo Engineers	Presents an evaluation of the existing sewer system, recommended facility improvements, and a capital improvement program for a planning horizon through 2025.
Hughson Water System Master Plan	2007	Carollo Engineers	Evaluates the need for water system master planning (including projected future demands) and proposes improvements to mitigate existing capacity deficiencies and expansion improvements.
Hughson Storm Drain Master Plan	2007	Carollo Engineers	Evaluated existing storm drainage system using hydraulic modeling and proposed improvements to enhance system reliability. Developed capital improvement program for buildout conditions of the 2005 General Plan (2030).

Document	Year	Author	Description
City of Hughson Urban Water Management Plan	2006	Carollo Engineers	Describes current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Hughson.
Oakdale Irrigation District Water Resources Plan	2005	CH2M Hill	Evaluates the district's water resources, delivery system and operations, and examines land use trends to determine how future changes in these areas will impact water supply and demand during the next two decades. Provides specific, prioritized recommendations for OID facility improvements that will comply with CEQA and accommodate available financial resources.
Integrated Regional Groundwater Management Plan for the Modesto Subbasin – Stanislaus and Tuolumne Rivers Groundwater Basin Association	2005	Bookman-Edmonston	Modesto, MID, Oakdale, Oakdale Irrigation District, Riverbank, and Stanislaus County formed the Stanislaus and Tuolumne River Groundwater Basin Association in 1994. They prepared this document since some or all of their service areas rely on groundwater for water needs. The Plan identifies Basin Management Objectives for the Modesto Subbasin, as well as groundwater management area objectives, and groundwater monitoring activities.
City of Hughson Storm Water Management Program, Report of Waste Discharge	2004	Tulloch Engineering	Describes the stormwater quality management activities proposed by the City of Hughson in compliance with the federal stormwater quality regulations.
Turlock Stormwater Management Plan	2003	City of Turlock	Includes description of stormwater management actions for the City of Turlock, Best Management Practices for six control measures, and the efforts the City will take to comply with all necessary requirements.
San Joaquin River Management Plan	1995	Advisory Council to DWR	Plan developed by an Advisory Council and Action Team representing wide range of Federal, State, and local agencies and private interests concerned with protecting the health of the San Joaquin River system. Describes and recommends specific projects, studies, and acquisitions that will help revive the San Joaquin River system.

Document	Year	Author	Description
General Plans (Stanislaus County, Turlock, Modesto, Ceres, Hughson, Waterford, Riverbank, Oakdale)	Various	Various	Formalize long-term visions for the County and cities within the East Stanislaus region. Every city and county in California must adopt a general plan; they serve as a legal document for land use and development. Most plans look 15 to 25 years into the future. Each Plan includes 7 elements – land use, circulation, housing, conservation, open space, noise, and safety.

The technical information included in these plans and studies is ideal for use in developing the East Stanislaus IRWMP. While some of these documents are project-specific, others address water and/or land management issues on a local or regional basis. This allows for an understanding of regional issues shared by multiple entities in the Region, as well as more specific, localized issues, and potential solutions. Furthermore, these documents have been developed by the local and regional entities to address and plan for future growth and development, as well as anticipated changes in climate, economic conditions, and land use. They have been performed with a technical level of care that justifies their use in the IRWMP development.

Beyond the analyses required to prepare this IRWMP, no additional focused models or studies were performed in support of this IRWMP. Although several such studies have been identified as a result of the IRWMP preparation, a lack of funding has, to date, prevented their implementation. These focused studies include preparation of a regional water needs assessment, a county island sewer connection study, and an integrated stormwater resources plan. These studies, once implemented, will help the ESRWMP fill identified data gaps in regional understanding, including projected future demands (on a regional level), areas where sanitary practices may be contributing to groundwater contamination, and opportunities for integrating stormwater management with other regional water supply management. Furthermore, two additional studies are presently underway that cover the IRWM region and will, once completed, be integrated into the East Stanislaus IRWMP. These studies are the Regional Flood Management Plan, which will evaluate flood management risks in the region and propose projects for addressing those risks, and CV-SALTS, a coalition of Central Valley stakeholders working to develop a workable, comprehensive plan to address salinity, including nitrates, throughout the region in a comprehensive, consistent, and sustainable manner. The results of the CV-SALT effort will include programs and management strategies to help manage salt and nutrient loadings to the Modesto and Turlock Subbasins.

The projects included in the East Stanislaus IRWMP have also been found to be technically feasible based on similar projects, pilot studies, technical analyses, benefit analyses, cost estimating, modeling and simulation efforts and data assessments by the project proponents, local planners, and the IRWM planning participating entities. As the projects move closer to design and implementation, technical analyses will be conducted to confirm project feasibility and to provide any necessary feedback to modify the project's plan to improve its likelihood of success. The following table summarizes project-specific documentation that supports the technical feasibility of the East Stanislaus IRWMP projects and the associated technical feasibility of IRWMP implementation.

Table 7-2: East Stanislaus IRWMP Project Technical Feasibility

Project	Documents Completed or Project Status	Description
Hughson Non-Potable Water System	Notice of Exemption (NOE) for the non-potable water distribution system for the City of Hughson (May 2012). Design and Phase 1 Implemented (December 2012).	A NOE was filed since the project is categorically exempt. Additionally, the project is similar to existing facilities currently in operation and is therefore technically feasible.
Hughson Water Blending Facility	Design started February 2013.	Project is similar to existing facilities currently in operation and is therefore technically feasible
Monterey Park Tract Community Safe Drinking Water Project	Water Supply Study for the Monterey Park Tract Community Services District (September 2011)	The Study was prepared for the California Department of Public Health (Safe Drinking Water State Revolving Fund Loan Program) and Stanislaus County Redevelopment Agency.
SRWA Regional Surface Water Supply Project	CEQA and 2013 CEQA Gap Analysis complete. Preliminary Design Report (PDR) complete. Re-evaluation of PDR currently underway for current project needs.	The project is a collaboration between the cities of Turlock, Modesto, and Ceres under the Stanislaus Regional Water Authority JPA. Studies and CEQA documentation completed and on-going.
North Valley Regional Recycled Water Program	Del Puerto Water District Recycled Water Feasibility Study, November 2010	Feasibility study reviews and evaluates recycled water delivery alternatives to provide DPWD with recycled water from Modesto and Turlock
Modesto Area 2 Stormwater to Sanitary Sewer Cross-Connection Removal Project	City of Modesto Area 2 Storm Drain to Sanitary Sewer Cross Connections Removal Final Design (2013)	The project is ready to proceed. Phase 1 of the project is underway as a result of funding through a State Stormwater Grant.
Hughson Water Well No. 9	Test Well is complete. Design of production well started February 2013.	Project is similar to existing facilities currently in operation and is therefore technically feasible
Hughson 7th Street Low Impact Development (LID) Storm Drainage Improvements	Program standards and specifications underway (started March 2013).	Project will be constructed using techniques developed by the City of Portland and the City of Seattle. Since both cities have working projects on the ground, this project is technically feasible.
Municipal Well #41	Turlock Water Master Plan Update, Carollo Engineers, 2009 Project plans and specifications	Master Plan identifies need for project. Plans and specifications provide detailed information required for project implementation.

Project	Documents Completed or Project Status	Description
Water Storage Reservoir NW	Turlock Water Master Plan Update, Carollo Engineers, 2009 Project plans and specifications	Master Plan identifies need for project. Plans and specifications provide detailed information required for project implementation.
Hughson Well No. 9 Arsenic Treatment Facility	Test Well Complete. Design of production facility started in February 2013.	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Canal Drive Stormwater Trunk Line	City of Turlock, Storm Drain Master Plan	Shows alternate means of conveying wastewater – construction of stormwater trunk line parallel to TID Lateral #4
Hughson Regional Surface Water Treatment Plant Pipeline Turnout	Hughson Water Master Plan, Carollo Engineers, 2007	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Arsenic Mitigation Project	Assessment of Arsenic Treatment Technologies	An evaluation of the City water system was conducted to determine if the City is required to install an arsenic removal system to meet the new standard and what current arsenic treatment technologies were best applied to the existing system. In determining preferred technologies, both capital and O&M costs were evaluated, along with site-specific concerns of waste disposal, size and location of treatment units, and staffing requirements for O&M. The assessment report provided the City with a planning level evaluation of currently used arsenic treatment technologies appropriate for the existing City wells and preliminary cost estimates for implementation.
DAC and Native American Outreach and Technical Assistance	Builds upon existing and ongoing IRWM-related outreach.	On-going outreach has been conducted as part of the East Stanislaus IRWM planning process. A more targeted approach will be taken with the implementation of this project. Sound technical assistance will be provided using common outreach techniques to contact DACs and Native American communities in the Region.
Online Data Management System	OPTI was developed as an IRWM project solicitation / tracking tool. This will build upon the existing OPTI system.	OPTI is being used by other IRWM regions throughout California and has proven successful in tracking project and IRWM-related information.

Project	Documents Completed or Project Status	Description
Regional County Island Sewer Connection Study	Will build upon existing data. No work completed to date.	Project would identify areas within the IRWM Region that rely on septic sewer systems, evaluate potential impacts on groundwater, determine whether positive conveyance systems could be extended to serve them or if other non-septic means could be developed to protect groundwater quality. Study will rely on existing, available data, and collect more data if necessary.
Regional Water Needs Assessment	No documents prepared to date; would build upon existing UWMPs and county population projections.	Project would develop a region-wide demand projection to increase the understanding and better management of local water supplies.
Integrated Stormwater Resources Management and Groundwater Augmentation Plan	No work completed to date.	Project will evaluate and describe stormwater management in the region and identify opportunities and projects that will provide flood protection, water supply augmentation, and other benefits including potential groundwater recharge opportunities.
Dennett Dam Removal	Dennett Dam Removal – Concept Level Basis of Design Report	The Report provides detailed information about the dam construction, site conditions, and considerations for the removal of the dam, including a comparison of alternatives and a recommended approach.
Northeast Storm Drainage Interceptor Project	Northeast Area Offsite Watershed Storm Drainage Evaluation (2005).	Project is at conceptual level. Project evaluated assessed stormwater management and runoff impacts from areas northeast of Modesto's General Plan Area.
Hughson Water Well No. 10	Hughson Water Master Plan, Carollo Engineers, 2007	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Hughson Water Well No. 11	Hughson Water Master Plan, Carollo Engineers, 2007	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Hughson Well No. 5 Depth Extension		Project is similar to existing facilities currently in operation and is therefore technically feasible.
Hughson Well No. 3 Depth Extension		Project is similar to existing facilities currently in operation and is therefore technically feasible.
Dos Rios Floodplain and Riparian Habitat Restoration	CEQA, permit acquisition, and earthwork design are complete for some phases of the project.	Project is similar to existing facilities currently in operation and is therefore technically feasible.

Project	Documents Completed or Project Status	Description
La Grange Floodplain Restoration and Spawning Gravel Augmentation	Conceptual planning complete. Design, CEQA documentation and permits still required.	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Tuolumne River Trail Project	Tuolumne River Regional Park Master Plan and Master EIR (2001)	The Joint Powers Authority of the Cities of Modesto and Ceres, and Stanislaus County adopted the Master Plan and a Master EIR for the Plan. The Tuolumne River Trail Project is included in both of these documents which provide a vision for the future of the Tuolumne River Regional Park.

7.3 Data Management

> The IRWMP must describe the process of data collection, storage, and dissemination to IRWM participants, stakeholders, the public and the State.
>
> Data is technical information (e.g. designs, feasibility studies), and information gathered for a specific project in any phase of development including planning, design, construction, operation and monitoring.
>
> - *Proposition 84 & 1E IRWM Guidelines*, December 2012, Page 21

Data management is an important aspect to IRWM planning because the process encompasses multiple water and wastewater agency service areas, various watersheds, political areas, and groundwater basins, and provides the foundation on which water resource management and planning decisions are made. On a regional basis, this data management includes multiple data sources and a variety of methods for data collection, processing and management. Additionally, the IRWM planning process itself generates significant amounts of data related to the project review process and implementation of the IRWMP, such as project and Plan performance monitoring data. As such, development of a comprehensive data management system is ideal to promote the efficient and effective use of data.

Data related to the East Stanislaus IRWMP includes project- and program-specific technical information, such as feasibility studies or design documents, and any data collected during project or program development, implementation, or operation or as a result of required monitoring efforts. Data that may be collected includes, but is not limited to:

- Groundwater elevations
- Groundwater quality data
- Groundwater pumping volumes
- Water demand
- Surface water diversions
- Location of sensitive species
- Stream flows and/or stages
- Wastewater treatment plant flow data
- Water quality data
- Weather data (precipitation, evapotranspiration, temperature)
- Land use data

At present, the East Stanislaus Region will utilize existing, industry-standard data collection and management procedures for implementation of IRWMP-related projects. Modification to these procedures may occur as a result of the development of a region-wide data management system in order to ensure consistency with this new regional database once it is established. Typically, only data that is meant to be publically available is uploaded to entities' websites and/or uploaded to Statewide databases. Projects implemented outside of the Region's IRWM Program will be encouraged to follow similar protocols to maximize usefulness and compatibility of data collected throughout the region, and to improve potential integration into statewide databases. The types of data to be collected and anticipated collection and storage procedures are presented in the sections below.

7.3.1 Data Needs within the Region

While there has been significant progress in the last decade in characterizing the Region's water supplies, demands, groundwater and surface water availabilities and quality, wastewater treatment and collection needs, and potential for recycled water use, there remain data needs within the East Stanislaus Region. For the most part, these data needs center around the portions of Stanislaus County not found within urbanized areas (such as Modesto, Turlock, Ceres, Hughson, Waterford, Patterson and Oakdale), and are required to fill data gaps in knowledge necessary for the effective management of regional water supplies. Additional data needs include information regarding local hydrogeology and opportunities for groundwater banking, data pertaining to localized flooding and storm water management, and region-wide information to promote the reuse of storm water management.

Many of the data gaps identified as a result of this IRWMP developed are addressed through inclusion of a project in this IRWMP. For example, there are many areas in rural Stanislaus County that are not connected to municipal sewer systems and instead rely on stand-alone septic tanks/systems for wastewater disposal. These areas, referred to as County "islands", are often the same areas that rely on private groundwater wells for water supply. Septic systems are, however, a key source of contamination to shallow groundwater aquifers and as such, pose a continuing source of groundwater quality problems for these rural communities and for the groundwater basins as a whole. Groundwater is a critical water supply for the East Stanislaus Region, and understanding and managing potential sources of contamination to the underlying groundwater basins is needed to sustain this important supply. The **Regional County Island Sewer Connection Study,** included in this Plan, would help identify County "islands" within the region that are on septic systems, determine potential groundwater impacts (current and future) from the septic systems, analyze the feasibility of connecting these areas to centralized or satellite collection and treatment systems, and perform an associated preliminary financial analysis of the most feasible and reasonable alternatives. The Study would build upon existing data and information gathered by the County.

Other projects included in the Plan that would help fill data gaps include the following:

- **Regional Water Needs Assessment** - The purpose of this study is to complete a comprehensive assessment of current and future potable water demands within the entire East Stanislaus Region. This information is critical to managing water supplies under various hydrologic conditions to ensure water supply reliability and to prepare for droughts and potential climate change impacts. In essence, one must know the demands in order to be able to ensure the supply. UWMPs have been prepared by many entities within the Region (for example, by the Cities of Modesto, Turlock and Ceres), but not all areas and water users are included in the urban water management planning jurisdictions as required by the State (e.g. Hughson), and these areas are typically dependent on groundwater as their primary supply. This task will help fill the information gap and assess the current and future demands from those parts of the region where UWMPs are not required and, as needed, update the information where UWMPs are required so as to provide the region with essential information regarding projected future demands in order to effectively manage their water supplies to meet demands in a sustainable fashion. As water demands within the Region continue to increase and as groundwater quality continues to be a major factor threatening the sustainability of regional supplies, it is critical that a complete understanding of regional demands be prepared; that new, supplemental supply sources be identified, obtained, and integrated into the Region's water supply portfolio; and that effective programs be established to protect and sustain existing regional water supplies for all users, including the environment.

- **North Valley Regional Recycled Water Feasibility Study -** Del Puerto Water District, in cooperation with the cities of Modesto and Turlock, are currently preparing the North Valley Regional Recycled Water Feasibility Study to evaluate the potential for regionalizing recycled water use in Stanislaus County. As presently envisioned, the project could produce and deliver up to 30,000 acre-feet per year (AFY) of disinfected tertiary treated recycled water to western Stanislaus County. The source of recycled water includes treated water from the Cities of Turlock and Modesto. Another related feasibility study will be completed to analyze options for conveying the recycled water to the west side of the county, to Del Puerto Water District and other potential users, where it could be used for irrigating food crops, public and privately owned landscaping, and for industrial uses. The feasibility study will further the understanding of how recycled water could be transported via the Delta-Mendota Canal (DMC), which is typically used to transport raw water. It will provide data and information to both the East Stanislaus Region and the Westside-San Joaquin Region. Regulatory and permitting requirements would be evaluated, as well as water rights and a DMC water quality mixing evaluation. For the mixing evaluation, field testing and numerical simulation of expected mechanical and chemical interactions between recycled water and raw water would be completed.
- **Integrated Stormwater Resource Management Plan and Groundwater Augmentation Plan** – The East Stanislaus Region will prepare an Integrated Stormwater Resources Plan to develop a comprehensive understanding of stormwater resource management in the region, including identification of areas where stormwater runoff is currently causing problems and where stormwater runoff is critical to maintaining habitats. It will also conduct a groundwater quality study of the Modesto and Turlock Groundwater Subbasins of the San Joaquin Valley Groundwater Basin to aid in understanding regional groundwater quality and the role that stormwater percolation has on groundwater quantity and quality. Lastly, it will analyze the feasibility of managed groundwater recharge in the East Stanislaus Region using stormwater runoff as potential source water. The Plan will contribute to better understanding of the underlying groundwater subbasins, the impacts of land use planning and stormwater management activities on the subbasins, and to developing possible, multi-benefit solutions for managing the Region's water resources and improving stormwater management.

While other projects included in the East Stanislaus IRWMP are not studies or plans, many of them will have data collection as an aspect of project development and completion. Additionally, some of the projects are not yet ready for construction; some require preparation of plans, design documents, and other technical reports. The methods for collection and storage of these documents and their associated data are described in the following sections.

7.3.2 Data Collection and Storage

To date, data collection and storage is primarily managed on an individual basis by the members of the ESRWMP and local stakeholders. At present, each entity collects and manages data using its own protocols and methodologies. The four ESRWMP member agencies house data on their respective servers and use software such as Microsoft Excel, ArcGIS, Supervisory Control and Data Acquisition (SCADA), New World Systems, and Wonderware. Some of the data collection completed by the ESRWMP member agencies is summarized in the following table.

Table 7-3: Data Collection for the ESRWMP Member Agencies

Data Type	Frequency of Data Collection	Method for Data Collection
Turlock groundwater quality	Monthly	Well sampling
Turlock groundwater elevations	Monthly	Electronic water level indicator
Turlock water demand	Daily	Meter readings
Modesto groundwater quality	Monthly, quarterly	Well sampling
Modesto groundwater elevations	Monthly	Sounding cable
Modesto water demand	Daily	SCADA, meter readings
Ceres groundwater quality	Annual	Well sampling
Ceres groundwater elevations	Quarterly	Sounding cable
Ceres water demand	Monthly	Meter readings
Hughson groundwater quality	Weekly, quarterly, annually	Well sampling
Hughson water demand	Daily	SCADA
Hughson wastewater treatment plan groundwater monitoring	Quarterly	Monitoring well sampling

The STRGBA is also implementing the Well Field Optimization Project in order to improve understanding of the Modesto Subbasin groundwater system and its infrastructure, and to develop tools for optimizing operations of well fields in the subbasin in conjunction with surface water resources. Phases 1 and 2 of the project have been partially funded by Local Groundwater Assistance grants from DWR. A key component of the project is an inventory of all the wells operated by the STRGBA member agencies (i.e. MID, OID, Stanislaus County and the cities of Modesto, Riverbank, and Oakdale) and development of a web-based data management system (DMS) where well data can be accessed, queried, plotted and shared amongst the member agencies. The DMS is a Microsoft Access database with a customized interface and customized Decision Support System tool to automate the decision process for system operators in selecting wells to meet deliveries.

A regional data management system proposed by the ESRWMP and referred to as the **Online Data Management System** is also included in the East Stanislaus IRWMP as a project; implementation of this data management system is pending funding. The Online Data Management System would create a consolidated web-based data management system to facilitate the collection and analysis of various data types, monitoring and reporting, and provide stakeholder access to data. This data management system would be developed to facilitate the sharing of data with existing State databases and the DMS created as part of the Well Field Optimization Project. The East Stanislaus Online DMS would connect with the East Stanislaus IRWMP website, located at http://www.eaststanirwm.org/. Presently, data and documents specific to the East Stanislaus IRWM planning process are uploaded to the website and made available for public review (including proposed projects through the Region's OPTI project solicitation website). The East Stanislaus Regional Water Management Partnership (ESRWMP) is responsible for maintaining the website and documents available there.

Stakeholders participating in the IRWM planning process and project proponents are responsible for collecting, storing, and maintaining project-specific data in the individual entity's existing data management system and are tasked with uploading necessary, publically available data to applicable statewide databases, discussed in more detail in Chapter 7, Technical Analysis and Data Management. Any required monitoring after project implementation will be implemented consistent with applicable standards and reported to the State. Each entity that uploads data to its DMS, the East Stanislaus IRWMP website, and/or applicable statewide databases performs quality assurance and quality control (QA/QC) measures to validate the data. These measures include third-party reviews of data collected, laboratory quality control measures such as blind duplicates and matrix spike samples, and model calibration and sensitivity analyses.

While each entity is responsible for QA/QC and maintenance of their individual data and databases, the ESRWMP or its designee will oversee any data compilation related to IRWMP implementation (including the implementation of projects contained within the IRWMP) for presentation on the region's website. By making data available by request and available online through the ESRWMP member agencies' websites, project proponents' websites, and the East Stanislaus IRWMP website, data transfer and sharing among the ESRWMP, participating entities, and interested parties including local, State and federal agencies is made possible.

7.3.3 Data Dissemination

During preparation of the East Stanislaus IRWMP, data has been disseminated primarily via project-specific documentation and associated meetings, inter-agency collaboration on issues and projects of mutual interest, discussion at PAC, SC, and ESRWMP meetings, and through website postings on the East Stanislaus IRWM Region's website. Project proponents, PAC members, and IRWM planning participants are all jointly responsible for data dissemination. As previously mentioned, project-specific data is shared by and between participating agencies during project development and made available to the public at various milestones. Environmental documentation processes completed to comply with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) have also allowed for dissemination of data developed for review by interested stakeholders and the public. These methods will continue to be employed.

As described previously, all data specific to the East Stanislaus IRWM planning process will be housed on the East Stanislaus IRWM website and/or maintained by implementing agencies. Project- and program-specific data will be housed on the project proponent's individual data management systems. Hard copies and CDs may be available to interested parties without internet access. Future East Stanislaus IRWMP updates will be distributed in a similar manner to that employed for this IRWMP.

As described in Section 7.3, Plan Performance and Monitoring, East Stanislaus IRWMP project proponents implementing projects through the IRWM Program will be required to prepare project-specific monitoring plans that adhere to the data collection techniques and procedures established by existing statewide programs. This will ensure compatibility of data among projects implemented through the IRWM Program, as well as compatibility with relevant statewide databases. Individual project proponents will be responsible for collecting data in accordance with the approved project-specific monitoring plan, which will clearly identify monitoring and analytical techniques and QA/QC procedures to be implemented, and will describe how those techniques are compatible with the requirements of appropriate statewide database(s). The individual project sponsor will be responsible for implementing and reviewing the data collection and QA/QC protocols to validate that data were collected in accordance with the QA/QC procedures required as part of the project monitoring program. In addition, project proponents will be responsible for reviewing the data for accuracy at the time of entry to the database to identify any errors. Once data collection and QA/QC has been completed in accordance with provisions of the approved project-specific monitoring plan, the project sponsor will submit the compatible data to the appropriate statewide database and provide the ESRWMP with confirmation that the data has been submitted to the appropriate statewide databases. Dissemination of data to statewide programs administered by the State Water Resources Control Board (SWRCB), the California Department of Water Resources (DWR), and other entities will support statewide data needs and allow for another method for public access. The current methods used to disseminate data to the State for programs such as CASGEM will continue in their present form, pending the development of a regional database.

East Stanislaus IRWM planning participants have supported statewide data needs in the past through voluntary participation, and will continue to do so in the future by making collected data available to programs such as the California Environmental Resources Evaluation System (CERES), Surface Water Ambient Monitoring Program (SWAMP), Groundwater Ambient Monitoring Assessment (GAMA) program, and the California Environmental Information Catalog (CEIC) when appropriate and feasible. Data will also be disseminated to DWR for inclusion in its databases, such as the Water Data Library (WDL), which contains groundwater level and water quality data. Finally, stakeholders, agencies, and the public may request all publicly available IRWMP data (i.e., non-proprietary and non-confidential) from any of the MOU signatories for this IRWMP.

Chapter 8 Plan Implementation

For the East Stanislaus IRWMP to be successful, projects included in the Plan must continue to move forward with planning, design, permitting, environmental documentation, construction and ultimately operation. Implementation of projects and programs included in the IRWMP will help the Region achieve its identified regional goals and objectives and will contribute to solutions to address issues and conflicts in the region. The process the East Stanislaus Region will apply for IRWMP implementation is described in Section 8.1. Potential financing options for continued IRWMP development and implementation is summarized in Section 8.2.

> The IRWMP must include a plan for implementation and financing of projects and the Plan itself. The financing discussion must, at a minimum, include the following:
>
> - List of possible funding sources for development and ongoing funding for the IRWMP.
> - List of funding mechanisms for projects that implement the IRWMP.
> - An explanation of the certainty and longevity of known or potential funding for the IRWMP and projects.
> - An explanation of how O&M costs for projects that implement the IRWMP would be covered and the certainty of funding.
>
> - *Proposition 84 & 1E IRWM Guidelines*, December 2012, Page 21

8.1 Implementation Process

Implementing the East Stanislaus IRWMP consists of:

- Implementing projects and programs included in the IRWMP;
- Monitoring projects and programs included in the Plan that are implemented to ensure they are meeting their goals and objectives and contributing to the East Stanislaus regional objectives.
- Regularly evaluate the East Stanislaus IRWMP to determine if movement has been made in achieving the regional objectives, and modifying the IRWMP, as necessary, to ensure that Plan (and the projects it contains) are on track to achieve the overall Plan goals.

Implementation of the East Stanislaus IRWMP will be completed through cooperation among the participating entities, including the East Stanislaus Regional Water Management Partnership (ESRWMP), the regional water management group for the region, the Steering Committee, Public Advisory Committee, project proponents, and stakeholders. In August 2011, the Cities of Ceres, Hughson, Turlock and Modesto signed a Memorandum of Understanding (MOU) for IRWM planning, forming the ESRWMP and agreeing to develop the East Stanislaus Region's first IRWMP. Upon completion and adoption of the East Stanislaus IRWMP, the ESRWMP will continue to coordinate implementation of the Plan and perform future IRWMP updates (as discussed in Section 8.4). Coordination with the project proponents will be necessary through the IRWM planning process, even after Plan adoption. While some of the projects included in the East Stanislaus IRWMP are projects to be implemented by the present ESRWMP member agencies, others are led by outside entities and stakeholders such as the Tuolumne River Trust, City of Waterford, and Keyes Community Services District. Individual project proponents will move projects forward as funding and staff is available, and as appropriate. For example, some projects included in the East Stanislaus IRWMP are considered ready to proceed, that is, ready for construction, but do not have adequate funding to construct. Others are at the conceptual level and require additional planning, design, and project development prior to construction and implementation. Regardless of the project status, funding must be available in order to proceed with project development and implementation. Financing is discussed in more detail in the following sections.

Implementation of the East Stanislaus IRWMP also involves monitoring performance of the IRWM program as a whole. Regular assessment of IRWMP performance and updates is described in Section 8.4, below.

8.2 Financing Plan

Because the East Stanislaus IRWMP is a living document and will require implementation and updates in the future, and because there are projects included in the Plan that will be implemented to achieve the region's goals and objectives, a financing plan is necessary to help ensure funding sources are available to do so. Additionally, as projects are implemented, not only is funding necessary for capital costs, but also for ongoing operation and maintenance (O&M) of the projects. The following sections discuss the potential funding sources that may be available for developing, maintaining, and updating the East Stanislaus IRWMP, the potential funding sources for projects that implement the IRWMP, and the certainty and longevity of the funding sources.

8.2.1 Funding for Development of IRWMP

Thus far, the cost of developing and maintaining the East Stanislaus IRWMP has been borne by the local entities involved in the ESRWMP, which includes the Cities of Modesto, Turlock, Ceres, and Hughson. In June 2010, the four cities entered into a cost-sharing agreement to prepare the East Stanislaus IRWMP. Additionally, city staff has contributed significant time and resources to completing the IRWMP, coordinating and participating on the Steering and Public Advisory Committees, and organizing stakeholder outreach efforts. The East Stanislaus region is committed to developing a useful and implementable IRWMP, which includes Plan performance monitoring and updating the Plan in the future to help ensure that Plan implementation addresses the conflicts and issues currently present in the region.

Many of the same potential funding sources available to local entities involved in the East Stanislaus IRWMP may be used for developing and updating the IRWMP, implementing projects and programs (i.e. funding capital costs of projects included in the IRWMP), as well as funding project O&M costs. An overview of potential funding sources is provided in Table 8-1. The primary sources of funding for developing, maintaining, and updating the East Stanislaus IRWMP are the cities' General Funds (or Capital Improvement Funds), utility rates, or local, state, or federal grants. According to the City of Modesto's Comprehensive Annual Financial Report for the fiscal year ending June 30, 2011, primary revenue sources of the City have been directly impacted by economic influences, causing a reduction in the City's General Fund budget. The City of Turlock also continues to weather through the protracted economic downturn, but Turlock's General Fund revenues seem to have stabilized over the decline of the last five years. The City of Ceres is also seeing decreases in sales and use tax revenues, property tax revenues, and investment revenues. Over the last three years, the General Funds have faced significant deficits due to increased costs and declining revenues, and local entities are still struggling to fund major infrastructure projects without assistance of other funding avenues. It is likely the same declines in general funding budgets are being experienced in cities throughout the East Stanislaus Region.

While funding for future IRWMP updates has not yet been secured by the ESRWMP member agencies, it is possible that funding will be available as the participating agencies and other regional stakeholders understand the critical nature of updating the IRWMP and addressing the region's changing issues and conflicts as conditions change, and will coordinate these updates with other required planning studies, such as the five-year Urban Water Management Plans.

Table 8-1: Potential Funding Sources Available for IRWMP Development, Project Implementation, and O&M Costs

Potential Funding Source	Description	Certainty / Longevity
Capacity Fees	• Used by water agencies as a means to achieve and maintain equity among its past, present and future customers. • Typically charged per connection, measured in equivalent dwelling units (EDUs). A single connection may encompass more than one EDU. In addition to the connection fee aspect of capacity fees, water agencies may also assess other fees (e.g., Commercial Acreage Fee [per acre] and Other Service Fee [per acre]).	Dependent upon rate structure adopted by project proponents and Proposition 218 process
User Fees	• Monthly user fees are assessed by some water agencies where an argument can be made that new facilities directly benefit existing customers. • In many cases, income from this monthly revenue source is used to pay debt service on debt financed assets.	Dependent upon rate structure adopted by project proponents and Proposition 218 process
User Rates	• User rates (also referred to as rate recovery) pay for O&M of a water agency or public utility's system. Within a water agency user rate, there is a fixed cost component that covers costs that do not vary with the amount of supplied water, such as labor and overhead expenses, and a variable cost component that covers costs that are based on the amount of pumping and applied chemicals to meet the water demands of the customers and vary with the amount of supplied water, such as the electrical and chemical costs. • A water agency customer pays a monthly fixed rate and a variable rate based on the metered usage. In cases in which billing is not based on a metered usage, a single monthly rate is assessed that combines the average of the fixed and variable rates.	Dependent upon rate structure adopted by project proponents and Proposition 218 process
General Funds	• General or capital improvement funds are monies that an agency sets aside to fund general operations and/or facility improvements, upgrades and, sometimes, development. These funds are usually part of their overall revenue stream and may or may not be project-specific. • The general fund budget is supported by revenues generated from a variety of taxes including sales tax, property tax, franchise fees, and a variety of permit fees.	Dependent upon annual budgets adopted by project proponents and participating agencies
Bonded Debt Service	• In cases in which a large facility is needed to support current services and future growth, revenue bonds are issued to pay for new capital. This allows for payment of the facility by bonded debt service at the time of construction with repayment of the debt service over a 20- to 30-year timeframe. • Preferred approach to paying for high cost facilities because it avoids the perceived over-collection of fees from past customers that go toward facilities that serve present and future customers. The downside to bonded debt is that it cannot be accomplished with capacity fees alone due to the variability and uncertainty of new development over time. A user rate is needed as a bond document covenant in the event that development fees are not adequate to make the required annual payment for the debt service.	Dependent upon bond market and existing debt of project proponents

Potential Funding Source	Description	Certainty / Longevity
Grants	• Typically require local matching funds. The matching requirement shows a local commitment to promoting and completing the study, plan, or project. • Typically administered and contracted by a single agency within the region that works directly with the state or federal agency administering the grant. • Grants typically carry relatively high administration cost because extensive grant reporting may be required, and typically only a small portion of the grant may be used to cover grant administration.	Grant programs at the local, state, or federal levels are periodically available. Some projects have secured grants as shown in the table in Appendix Q.
Low-interest loans	• Several funding agencies administer low-interest loans for implementation of water- and wastewater-related projects. Low-interest loans can save the implementing agency significant amounts of money by reducing interest payments as compared with traditional bonds. • SWRCB offers low-interest loans for wastewater and recycled water projects through its Clean Water State Revolving Fund (SRF) loan program. Approximately $200 million to $300 million available annually. The interest rate is half of the most recent General Obligation (GO) Bond Rate at the time of the funding commitment. Over the last five years, the Clean Water SRF loan interest rate has ranged from 1.8% to 3.0%. • CDPH administers a similar SRF loan program (Safe Drinking Water SRF loan program) for drinking water-related projects. Amounts available through the CDPH Safe Drinking Water SRF loan program vary, but approximately $100 to $200 million is available annually. • The California Infrastructure and Economic Development Bank (I-Bank) administers the Infrastructure SRF loan program for financing implementation projects such as sewage collection and treatment, water treatment and distribution, and water supply projects.	Dependent upon the specific program and federal appropriations to each

8.2.2 Funding for Projects that Implement the IRWMP

Agencies within the region have explored a variety of potential regional water resource planning and implementation funding vehicles including the State Revolving Fund (SRF), U.S. Bureau of Reclamation's Title XVI Reclamation and Recycling Program, and other State and Federal grant and loan programs, in addition to rate revenues, bond financing, assessments, and potential county and municipal revenue sources.

With regard to projects and programs which implement the East Stanislaus IRWMP, estimated capital and O&M costs are shown in Appendix J, along with potential funding sources, exclusive of additional local, state or federal grant funding. It should be recognized that each implementing organization has a unique set of revenue and financing methods and sources.

Ongoing support and financing of the O&M of projects in this IRWMP are expected to be derived from many of the same sources that were identified to fund project implementation, as shown in Table 8-1. Support and financing will likely come primarily from local sources, including user rates, fees and assessments. Since regional projects and programs often involve multiple partner agencies, the range of local sources available is broadened. The details of financing these larger, multi-partner projects are typically worked out on a project-by-project basis. Large multi-purpose projects typically adhere to standard cost accounting and cost of service principles which are typically described and codified in the agreements for ownership. Operation and maintenance of facilities is typically developed as part of a project financing package.

O&M costs of proposed implementation projects must be evaluated as the overall viability of a particular project effort is determined. Any project that is advanced for implementation consideration must include an analysis to determine the ability to operate and maintain the project and project benefits. The annual fiscal impact on user rates, and the willingness of ratepayers to accept any increased cost of service as may be required for project implementation must be included in this analysis. The need for water and the economic hardship impacts that would occur, should the new source not be available, may also be considered as part of the analysis.

8.3 Plan Performance and Monitoring

Plan performance and monitoring is vital in IRWM planning as it helps a region determine if implementation of its IRWMP is contributing to meeting its identified goals and objectives. Measuring the success of Plan implementation is directly related to IRWMP project implementation, and therefore, the monitoring required as part of the East Stanislaus IRWMP implementation will evaluate both project-specific performance in meeting project goals, in addition to how the overall IRWMP implementation is meeting the Region's goals and objectives.

> The IRWMP must contain performance measures and monitoring methods to ensure the Plan Objectives are met.
>
> This Plan Performance and Monitoring section shall describe the method of evaluating and monitoring the RWMG's ability to meet the objectives and implement the projects in the IRWMP.
>
> - *Proposition 84 & 1E IRWM Guidelines*, December 2012, Page 21

As described in Section 6.2.4, individual project proponents implementing projects through the East Stanislaus IRWMP will be responsible for collecting data in accordance with approved project-specific monitoring plans and submitting data to appropriate statewide databases. These data will include the information necessary for monitoring project-specific performance. Projects that affect surface water quality shall include a monitoring component that allows the integration of data into the California Environmental Data Exchange Network (CEDEN). Similarly, groundwater-related project, must monitor and report groundwater elevation data, as required by CWC §10920 *et seq.* and may be required to monitor groundwater quality, depending on the project's nature.

Monitoring the East Stanislaus Plan performance will be based on the results of project-specific performance monitoring, and cumulatively will help ensure:

- The Region is making progress towards meeting the goals and objectives as specified in the IRWM Plan.
- Projects included in the East Stanislaus IRWMP are being implemented.
- Each project in the IRWM Plan is monitored to comply with all applicable rules, laws, and permit requirements.

Project-specific monitoring plans will be prepared and implemented by the project proponents for projects that are implemented as part of the East Stanislaus IRWMP (i.e. projects funded through the IRWM grant program). The project proponent will also be responsible for all project-specific monitoring activities and for reporting the results of the monitoring program to the designated ESRWMP agent. While projects that are not implemented through the East Stanislaus IRWMP will not be required to have project-specific monitoring completed, project proponents and participating entities will be encouraged to prepare and implement performance monitoring plans as part of their project implementation. Performance data for non-IRWMP projects will be collected and evaluated as made available.

In general, project-specific monitoring plans will include the following information:

- The project name and a brief description
- List of the project goals and objectives
- Identified targets to be achieved over the life of the project (e.g. reduce water loss from the tank by 8%)
- Description of what is being monitored for, in table format (see example below), including the location of monitoring, monitoring frequency, methods used to collect data, and procedure for data collection/storage
- Measures to remedy or react to problems encountered during monitoring. An example would be to coordinate with the Department of Fish and Game if a species or its habitat is adversely impacted during construction or after implementation of a project.

Table 8-2: Example of Monitoring Table included in Project-Specific Monitoring Plan

Parameter	Location of Monitoring	Frequency	Monitoring Protocol / Methodology	Data Collection, Storage, and Dissemination Procedures
Surface water diversion	Water meter at San Joaquin River mile X	Weekly	Use meter data to monitor monthly surface water diversions	Store data on City of Modesto existing DMS, upload project monitoring report to East Stanislaus IRWMP website, and submit groundwater level data to SWAMP
Groundwater recharge	Water meter on discharge pipe to percolation pond	Daily	Use meter data to monitor daily discharges to percolation ponds	Store data on City of Modesto existing DMS, upload quarterly reports to East Stanislaus IRWMP website
	Water levels (staff gauge) in percolation pond	Daily	Use gauge data to estimate weekly volume of percolated water	Store data on City of Modesto existing DMS, upload quarterly reports to East Stanislaus IRWMP website

Project-specific monitoring plans may be prepared at different stages of project development, but all will be prepared prior to the start of construction and will be submitted to the ESRWMP for review and consideration. Each monitoring plan will specify monitoring protocols and methodologies to ensure consistency and accountability by the project proponent collecting the data and performing monitoring activities. The ESRWMP will act as the overseeing entity, making sure each project proponent prepares its project-specific monitoring plan and implements the plan accordingly, and ensuring that the required reporting and data uploads occur. The monitoring plans will include monitoring schedules, dictating an estimated timeline of monitoring activities which the ESRWMP will use as a guideline to ensure a monitoring schedule is maintained. Prior to project implementation, the project proponent must be able to ensure that adequate funding will be available to complete the necessary project monitoring. Data collected and analyses performed as part of the performance monitoring plans will be reported to the ESRWMP on a semi-annual basis, at a minimum, providing required documentation and proof of project performance. Data and information collected as part of the project-specific monitoring plan will be summarized in a project-specific monitoring report, in table format, and submitted to the ESRWMP for review. Necessary backup information will be attached to the report. An example of the monitoring report table is provided in Table 8-3. This will help ensure the projects meet the goals and objectives as originally conceived for the projects and the East Stanislaus IRWMP.

Where possible, ongoing data collection efforts will be relied upon, at a minimum, to provide necessary baselines to measure project and Plan success. In some cases, monitoring and data collection currently underway will be adequate for project performance monitoring. For example, with respect to surface water rights, an entity diverting surface water must submit data to SWRCB. The data is housed on eWRIMS – the Electronic Water Rights Information Management System. This data, which is already collected for certain water bodies, could help gauge effectiveness of a project meant to increase or decrease flows in a portion of a river. Similar to eWRIMS, SWRCB administers Groundwater Ambient Monitoring Assessment (GAMA) program. Groundwater production wells are monitored by the well owners and volumes pumped are reported to CDPH, who puts that information on GAMA. Additionally, GAMA has data from DWR, USGS and the Department of Pesticide Regulation. The data that exists on GAMA could be used to develop baseline conditions of a groundwater basin and could potentially be relied upon to track conditions and measure project effectiveness.

Table 8-3: Example Project-Specific Monitoring Report

Project Name:	Insert name
Project Description:	Briefly describe the project
Identified Project Goals and Objectives:	Insert goals and objectives as identified in project specific monitoring plan
Project Targets:	List specific, measurable targets, as described in the project specific monitoring plan
Data Collected:	Describe the data collected (including collection location) and how often it was collected
Measurement tools and methods:	Describe the tools and methods used to collect data, as described in the project specific monitoring plan, and how that data is being managed and/or uploaded to existing databases
Goals and Objectives Results Summary:	Describe how the project is meeting its identified goals and objectives
Project Targets Results Summary:	Describe if the project is on track to meet its identified targets based on the data collected, including schedule and fiscal targets
Recommended Modifications or Adjustments	Describe any remedy or recommended actions that should be implemented (if any) to counter problems identified through implementation of the monitoring plan

As described in Section 6.2.2, project proponents will be responsible for collecting, storing, and maintaining project-specific data on the individual entity's existing DMS and are tasked with uploading necessary data to applicable statewide databases. Any required monitoring after project implementation will be collected consistent with applicable standards and reported to the State. Each entity that uploads data to its DMS, the East Stanislaus IRWMP website, and/or applicable statewide databases will perform quality assurance and quality control (QA/QC) measures to validate the data. While each entity is responsible for QA/QC and maintenance of data, the ESRWMP will oversee any data compilation for the region's website. By making data available online through the various websites and online DMSs, data transfer and sharing among the ESRWMP, participating entities, and interested parties including local, State and federal agencies is made possible.

The information and data collected as part of the project-specific monitoring plans will be fed back to the individual project's management structure to adapt the project to better meet its overall objectives. Only by consistent monitoring and analysis of project performance feedback data can projects successfully achieve the objectives set for the project. Monitoring will also provide a clear reporting mechanism for the public, decision makers, and regional planners to determine the planned versus actual value of the project. Results from project-specific monitoring will also be used to improve the ESRWMP's ability to identify and implement future projects in the East Stanislaus IRWMP and identify revisions to the IRWMP itself. As previously mentioned, the project proponents will submit project-specific monitoring reports to the ESRWMP on a semi-annual basis. Annually, the ESRWMP will evaluate how the projects implemented as part of the East Stanislaus IRWMP are not only addressing the identified project-specific goals and objectives, but how overall

Plan implementation is contributing the identified regional goals and objectives included in the most recent adopted IRWMP. If adequate progress is not being made in addressing the Plan objectives, the region may choose to implement other projects in the future or re-evaluate the projects currently in the Plan. This will help the region as it updates its project list, the IRWMP, and applies for grant funding.

8.4 Plan Updates

The East Stanislaus IRWMP is meant to be a living document and will therefore periodically be updated to reflect changing conditions such as population growth and climate change, as well as project implementation in the Region. The Region's needs will undoubtedly change in the future, and as they do, regional objectives must be re-evaluated and new, applicable regional solutions identified. On an annual basis, the Plan implementation will be assessed as to its performance in achieving the identified regional objectives and a memorandum prepared summarizing that assessment. Further, the ESRWMP will update the East Stanislaus IRWMP when deemed appropriate; this could be when one or more of the following criteria are met:

- Five years since the last Plan adoption.
- DWR updates its IRWM Plan Guidelines and associated Plan Standards.
- DWR releases a Proposal Solicitation Package (PSP) for IRWM implementation grants.
- Project and plan monitoring have occurred leading to the identification of needed revisions to the East Stanislaus IRWMP or projects included in the Plan.

The prioritized project list, contained in the appendices of the IRWMP, will be revised, at a minimum, on an annual basis, for the first 5 years. After 5 years, the project list will be updated on a bi-annual (every 2 years) basis. The revised project list will be vetted by the ESRWMP among regional stakeholders following updating, and upon receiving consensus, will substitute the updated project list for the one currently contained herein. No formal plan adoption or re-adoption will be required for project list updating. Similarly, should administrative revisions be made to the IRWMP (e.g. based on DWR recommendations during completeness review), the Plan may not require re-adoption. Table 8-4 summarizes the long-term maintenance activities to be conducted for the East Stanislaus IRWMP; the frequencies identified for each activity are minimum frequencies.

Table 8-4: Summary of Long-Term East Stanislaus IRWMP Maintenance Activities

Activity	Frequency
ESRWMP Meetings (financing, regional water resources issues, other)	Quarterly
Project Solicitation, Review, Integration and Prioritization	Annually
Plan and Project Monitoring and Performance	Annually
IRWM Plan Review and Update	Every 5 years
Outreach	Quarterly

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