MIRWMA

Merced Integrated Regional Water Management Authority

2018 Merced Integrated Regional Water Management Plan Update

FINAL

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PREPARED BY

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Acronyms and Abbreviations

AB	Assembly Bill
ACS	American Community Survey
AF	Acre-feet
AFY	Acre-feet per year
AWMP	Agricultural Water Management Plan
BIA	Bureau of Indian Affairs
BMPs	Best Management Practices
CARB	California Air Resources Board
CASGEM	California Statewide Groundwater Elevation Monitoring
CAT	Climate Action Team
CDPH	California Department of Public Health
CEDEN	California Environmental Data Exchange Network
CEQA	California Environmental Quality Act
Cr6	Hexavalent chromium
CSD	Community Services District
CT	centroid timing
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
CWD	Chowchilla Water District
DAC	Disadvantaged Community
DBCP	Dibromochloropropane
DDW	Division of Drinking Water
DMM	Demand Management Measure
DMS	Data Management System
DWR	Department of Water Resources
EDA	Economically Distressed Area
EJ	Environmental Justice
EMRCD	East Merced Resource Conservation District
FCWD	Franklin County Water District
FEMA	Federal Emergency Management Agency
FPLAA	Food Processing Land Application Area
GAMA	Groundwater Ambient Monitoring and Assessment
GCM	General Circulation Models
GHG	Greenhouse Gas
gpd	Gallons Per Day
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan

Guidelines	Prop 1 IRWM Guidelines
IPCC	Intergovernmental Panel on Climate Change
IRWM	Integrated Regional Water Management
JPA	Joint Powers Authority
LFD	low flow duration
LID	Low Impact Development
LTMWC	Lone Tree Mutual Water Company
M&I	municipal and industrial
MAF	mean annual flow
MAGPI	Merced Area Groundwater Pool Interests
MCL	Maximum contaminant level
MCSG	Merced County Streams Group
mgd	Million gallons per day
Mg/L	Milligrams per liter
MHI	Median household income
Merced WSP	Merced Water Supply Plan
MHI	Median household income
MID	Merced Irrigation District
MIRWMA	Merced Integrated Regional Water Management Authority
MIRWMP	Merced Integrated Regional Water Management Plan
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
MTBE	methyl-tertiary-butyl-ether
MWELO	Model Water Efficient Landscape Ordinance
NEPA	National Environmental Policy Act
NGOs	non-governmental organizations
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PCE	Perchloroethyene
QA/QC	quality assurance and quality control
RAC	Regional Advisory Committee
RAP	Region Acceptance Process
RCP	Representative Concentration Pathways
Region	Merced Region
RMS	resource management strategy
RWMG	Regional Water Management Group
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition

SDAC	Severely Disadvantaged Community
SED	Substitute Environmental Document
SGMA	Sustainable Groundwater Management Act
SNAMP	Sierra Nevada Adaptive Management Project
SRF	State Revolving Fund
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWRP	Stormwater Resources Plan
TCE	Trichloroethylene
TCP	1,2,3-Trichloropropane
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USACE	U. S. Army Corps of Engineers
USEPA	U. S. Environmental Protection Agency
USGS	United States Geological Society
UST	Underground storage tank
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound
WDR	Waste Discharge Requirements
WEAP	Water Evaluation and Planning System
WRAMP	Wetland and Riparian Area Monitoring Plan
USDA	U. S. Department of Agriculture

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Merced Integrated Regional Water Management Plan

Chapter 1 Introduction

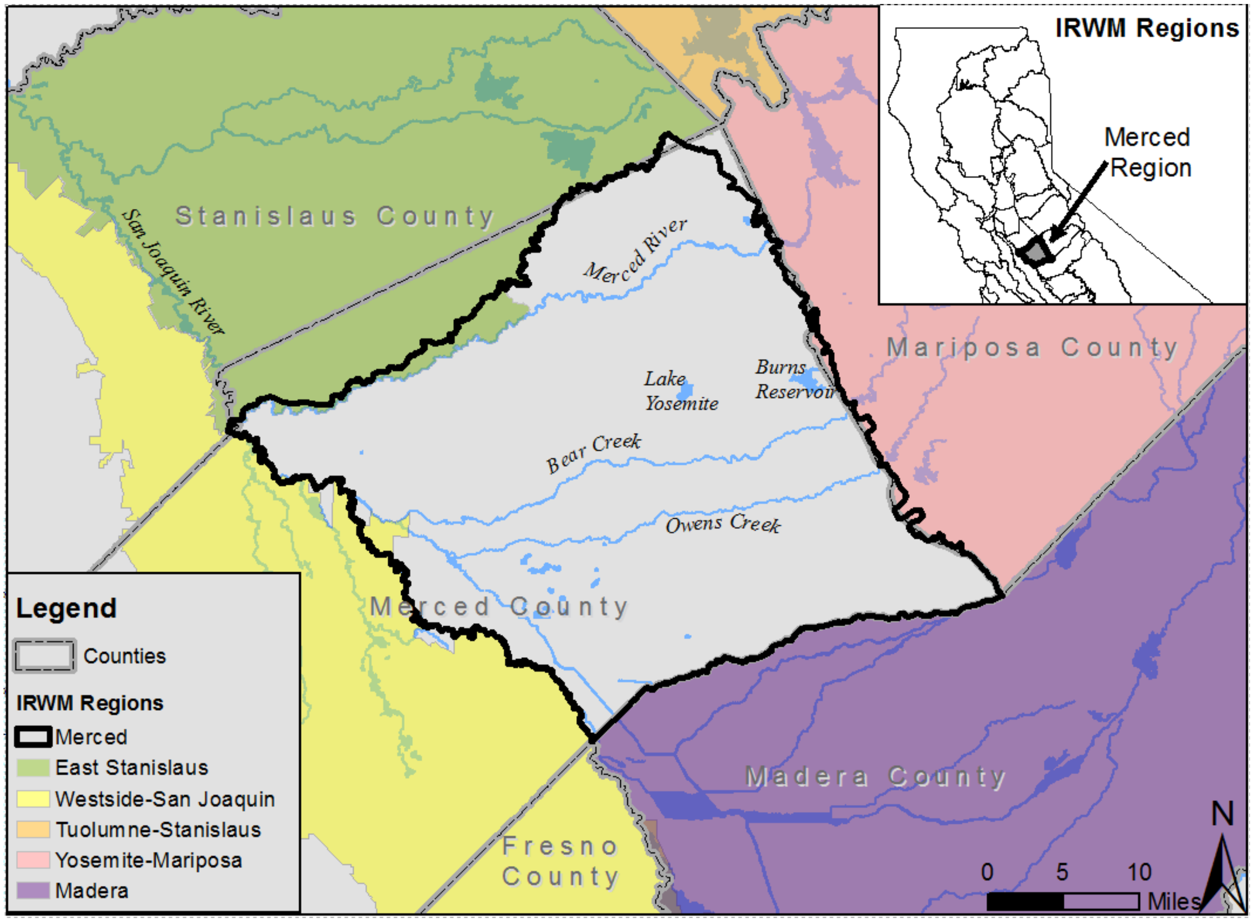
The Merced Integrated Regional Water Management Plan (MIRWMP), which encompasses the Merced Integrated Regional Water Management (IRWM) Region (Merced Region or Region), was developed through a stakeholder-driven process, building upon the Region's successful history of collaboration on water resource management issues. The MIRWMP represents the culmination of years of cooperative and collaborative planning among regional stakeholders.

1.1 Overview

The Merced Region encompasses the northeast portion of Merced County as shown in Figure 1-1. Its boundaries are generally defined by the eastern boundary of the Merced and Turlock Groundwater Subbasins on the east, the San Joaquin River to the west, the northern boundary of the Dry Creek watershed to the north, and the Chowchilla River to the south. Low-lying areas north of the Merced River between the river's confluences with Dry Creek and the San Joaquin River are also included in the Region.

The eastern and western boundaries of the Merced Region are critical hydrogeologic features that distinguish the Region from neighboring regions, and these distinctive boundaries were recognized by the California Department of Water Resources (DWR) through the Region Acceptance Process (RAP). The crystalline basement rock that defines the Region's eastern boundary divides the groundwater/alluvial basin of the Merced Region from the fluvial and fractured rock systems of the mountainous watersheds of Tuolumne and Mariposa Counties. On the west, the San Joaquin River marks the boundary between Merced Subbasin and the Delta-Mendota Subbasin and is also the dividing line between the Merced Region and Westside-San Joaquin IRWM Region. Beyond having distinctly different groundwater basins, the Merced Region has different water management and land use patterns than the Westside-San Joaquin Region, including the Merced Region's lack of reliance on imported sources of water. Additionally, while areas both east and west of the San Joaquin River are dominated by the agricultural industry of the Central Valley, the agricultural economy of the Merced Region is typified by small-scale multi-generational family farming operations, especially in areas that hold pre-1914 water rights. This is in contrast to the large-scale commercial agricultural operations common in areas west of the San Joaquin River.

Figure 1-1: Merced Region



Unlike its neighboring regions, the Merced Region is marked by an extensive network of creeks. Managing the numerous creeks and channels that traverse the basin poses a significant challenge for the Region, and flooding – along with associated water quality impacts – is a major issue facing the Region. Merced is part of the agricultural economic engine of the Central Valley, which not only supports California but accounts for the majority of agricultural production in the United States. The average annual value of agricultural production in Merced County between 2006 and 2016 was approximately $3.0 billion; much of that production is sustained by irrigation (Merced County, 2017). As noted in the California Water Plan Update 2009, California agriculture is resource-dependent; it depends on land, water, and labor. Protection of the land, water resources, and communities of the Merced Region is key to supporting the agricultural productivity of the Region, which in turn supports the economy of the State.

Despite its vital role in supporting California's economy, the Merced Region encompasses one of the most economically depressed areas of the state. As of 2016, the median household income (MHI) in Merced County was $44,397, and the unemployment rate was 15.7% (U.S. Census Bureau, 2017). Moreover, 20.3% of the Merced County population is below the poverty level, compared to 13.3% in California overall (U.S. Census Bureau, 2017). The Merced Region includes the incorporated cities of Atwater, Livingston, and Merced, and several unincorporated communities. Many communities within the Merced Region have an MHI of less than 80% of the statewide MHI, thus meeting the State's definition of a disadvantaged community (DAC). As such, nearly the entire Merced Region (92% by area) is considered a DAC. DACs are discussed in detail in Section 2.8 of this Plan.

With challenging economic conditions and a strongly water-dependent agricultural economy, water issues in the Merced Region are well-understood and are treated as a high priority. Water resources stakeholders in the Merced Region are committed to identifying opportunities to collaborate to improve water management in the Region.

This commitment to collaborative water resources planning is evidenced by the Region's history of successful cooperative water management planning. Since 1997, the Merced Area Groundwater Pool Interests (MAGPI), which lies wholly within the Merced Region, has been meeting to develop technical data and management strategies to improve the health of the groundwater basin, which is generally in overdraft. MAGPI members and non-member interest groups include most of the agencies with water supply, water quality and water management authority in the Region. However, the focus of MAGPI is limited to management of the groundwater basin. In 2008, MAGPI established a subcommittee to encourage cooperative planning among additional aspects of water resources management beyond groundwater management and to lay the groundwork for development of the Region's first IRWM Plan. MAGPI completed the Merced RAP application in April 2009 and subsequently secured a DWR IRWM Planning Grant in February 2012 to develop the first MIRWMP.

In 2012, MAGPI transferred responsibility for development of the MIRWMP to an interim Regional Water Management Group (RWMG) comprised of the City of Merced, County of Merced, and Merced Irrigation District (MID). In 2016, a Joint Powers Authority (JPA), comprised of these three entities in addition to the Cities of Livingston, and Atwater, was formed to further IRWM in the Region. This JPA is known as the Merced Integrated Regional Water Management Authority (MIRWMA) and acts as the current RWMG for the Merced Region. MIRWMA is responsible for overseeing the IRWM planning process, and each of its members has committed to continue to support the MIRWMP.

The Merced IRWM process has been a strongly stakeholder-driven process. MIRWMA is advised by a Regional Advisory Committee (RAC) that represents the broad interests of the Merced Region and shapes the direction of the IRWM program. The RAC was formed in May 2012 following an application process. All parties that applied for inclusion on the RAC were accepted as either full or alternate members and were officially appointed by the MID Board of Directors in consultation with member agencies represented by the RWMG. RAC membership was revisited prior to the kickoff of the 2018 MIRWMP Update; the RAC currently consists of 16 members representing broad interests and perspectives in the Region, including:

- Water / Wastewater
- Civic / Local Government
- Agricultural
- Other Business (non-agriculture)
- Environmental
- Other Institutional (e.g. University of California, Merced)
- DAC and Environmental Justice
- Recreation
- Community / Neighborhood

This broad-based involvement by regional stakeholders, via the RAC, has led to balanced input that reflects the wide array of water resources management perspectives throughout the Region. During the 2018 MIRWMP update, five RAC meetings were held. Additionally, two public workshops were conducted to inform community members and solicit input on the MIRWMP. The public draft of the MIRWMP was also made available for public comment. Finally, presentations on the MIRWMP were provided at three MIRWMA meetings, which are open to the public and at which public comments may be provided.

Completion of this MIRWMP represents attainment of a critical water resources planning milestone for the Region. This document, and the stakeholder process by which it was established, will serve as a blueprint for water resources management for years to come.

1.2 Document Organization

This MIRWMP was prepared to address the requirements of the Prop 1 IRWM Guidelines (Guidelines), finalized and released by DWR in July 2016 (DWR, 2016). Table 1-1 summarizes the sections of the MIRWMP that address each IRWM Plan Standard.

Table 1-1: MIRWMP Sections Addressing IRWM Plan Standards

IRWM Plan Standard	MIRWMP Chapter
Governance	Chapter 3 Governance
Region Description	Chapter 2 Region Description
Objectives	Chapter 4 Objectives
Resource Management Strategies	Chapter 5 Resource Management Strategies
Integration	Chapter 6 Project Review Process, Section 6.2.1 Principles of IRWM Planning Chapter 14 Stakeholder Involvement, Section 14.3 Stakeholder Integration
Project Review Process	Chapter 6 Project Review Process
Impacts and Benefits	Chapter 7 Impacts and Benefits
Plan Performance and Monitoring	Chapter 8 Plan Performance and Monitoring
Data Management	Chapter 9 Data Management
Finance	Chapter 10 Finance
Technical Analysis	Chapter 11 Technical Analysis
Relation to Local Water Planning	Chapter 12 Relation to Local Water Planning
Relation to Local Land Use Planning	Chapter 13 Relation to Local Land Use Planning
Stakeholder Involvement	Chapter 3 Governance Chapter 14 Stakeholder Involvement
Coordination	Chapter 15 Coordination

Climate Change	Chapter 2 Region Description, Section 2.10 Potential Effects of Climate Change on the Region Chapter 4 Objectives, Section 4.3Water Management Objectives Chapter 5 Resource Management Strategies, Section 16.5 Strategies for Climate Change Chapter 6 Project Review Process, Section 16.5.1 Climate Change Adaptation RMS Chapter 8 Plan Performance and Monitoring, Section 8.3 Adaptive Management Chapter 16 Climate Change

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Merced Integrated Regional Water Management Plan

Chapter 2 Region Description

This chapter addresses the Integrated Regional Water Management (IRWM) Region Description Plan Standard that requires IRWMPs to describe the IRWM region, including:

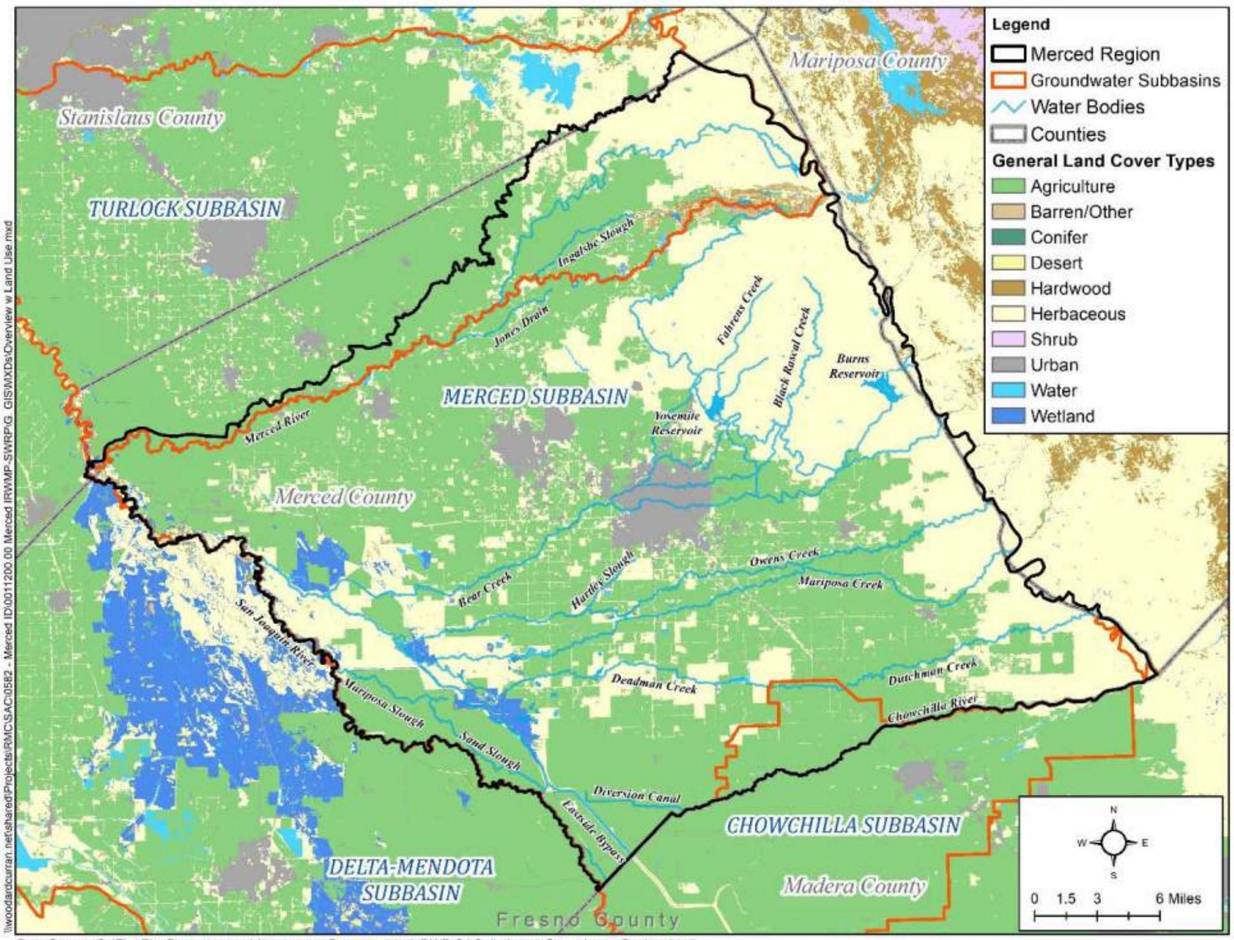
- ✓ Watersheds and water systems, including major water related infrastructure, flood management infrastructure, and major land-use divisions
- ✓ Quality and quantity of water resources within the region
- ✓ Areas and species of special biological significance and other sensitive habitats within the region
- ✓ Internal boundaries within the region including the boundaries of municipalities, service areas of individual water, wastewater, flood control districts, and land use agencies
- ✓ Water supplies and demands for a minimum 20-year planning horizon, including water demands from important ecological processes and environmental resources within the region
- ✓ Potential effects of climate change on the region
- ✓ Comparison of current and future (or proposed) water quality conditions in the region and water quality protection and improvement needs or requirements, including a description of location, extent, and impacts of nitrate, arsenic, perchlorate, or hexavalent chromium contamination and actions undertaken to address the contamination
- ✓ Social and cultural makeup of the regional community, including important cultural or social values, DACs, economic conditions and economic trends, and efforts to collaborate with Tribal government representatives (if applicable)
- ✓ Major water-related objectives and conflicts in the region, including problems within the region that focus on the objectives, implementation strategies, and implementation projects
- ✓ Explanation of how the IRWM regional boundary was determined and why the region is an appropriate area for IRWM planning
- ✓ Identification of neighboring and/or overlapping IRWM efforts (if any) and an explanation of the planned/working relationship between regions

Within the Merced Region, stakeholders with an interest in water resources have a long history of cooperation. The Region has all of the components necessary to produce an effective IRWMP that reflects broad collaboration by stakeholders within the region. Consistent challenges, terrain, and natural features present throughout the Region establish a sound basis for logical and cohesive IRWM planning. The Region’s stakeholders are enthusiastic about this effort, which represents a major step toward integrating the various water management challenges and opportunities facing the Region. To support the integrated planning process, the Region formed a JPA, MIRWMA, which helps facilitate IRWM planning along with the RAC and public stakeholders. The following sections provide an overview of the Merced Region and its water management conditions, needs, and challenges.

2.1 Selection of Regional Boundary

The Merced Region encompasses approximately 607,000 acres in the northeast portion of Merced County. Its boundaries are defined by the Merced Groundwater Subbasin boundary on the east, the San Joaquin River to the west, the Dry Creek watershed to the north (a tributary to the Merced River), and the Chowchilla River to the south. The Region was approved by DWR through the 2011 RAP. As shown in Figure 2-1, the Region includes primarily agricultural and some urban lands located on the San Joaquin Valley floor in Eastern Merced County. Groundwater resources in the Region have been extensively developed since the 1870s and managed conjunctively with the Region's surface water resources to satisfy regional agricultural, urban and environmental water demands.

Figure 2-1: Merced Region Overview



Data Source: CalFire Fire Resources and Assessment Program, 2015; DWR CA Bulletin 118 Groundwater Basins, 2017

The Region is primarily defined by the 513,000-acre Merced Groundwater Subbasin (Merced Subbasin), but it also includes portions of the Chowchilla Groundwater Subbasin to the south and the Turlock Groundwater Subbasin to the north, totaling approximately 607,000 acres. The portion of the Chowchilla Subbasin that is included in the Region coincides with the area encompassed by MAGPI's boundary, which is the portion of the subbasin within Merced County. MAGPI includes this portion of the Chowchilla Subbasin because this boundary is more consistent with natural hydraulic boundaries than the jurisdictional boundary (which is the basis for the DWR Bulletin 118 division between the Merced Subbasin and

Chowchilla Subbasin). The portion of the Turlock Subbasin that underlies the Dry Creek watershed and the low-lying areas north of the Merced River between its confluence with Dry Creek and its confluence with the San Joaquin River is included in the Region. Dry Creek is included in the Region as the only major tributary to the Merced River within Merced County, and consequently, the portion of the Turlock Groundwater Subbasin that underlies this area is also part of the Merced Region.

Land use patterns in the Merced Subbasin and the Merced IRWM boundary area are dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crops, and nut and fruit trees. These uses rely heavily on water purveyors/districts, private groundwater wells and surface water sources. Urban land use relies on groundwater except for limited landscape applications. Land use is primarily controlled by local agencies (e.g., cities or County).

The Merced Region boundary is not based solely on geographic, hydrologic, and watershed delineations considerations or characteristics. The boundary has been carefully evaluated and defined to align with water management boundaries and areas represented by regional stakeholders. The Merced Region boundary was also designed to diversify and strengthen the regional water management portfolio. Specific considerations that contributed to the regional boundary definition included:

Differing Hydrogeology. The crystalline basement rock at the eastern edge of the Merced Subbasin is a critical hydrogeologic feature that was considered in developing the Merced Region boundary. With the exception of the Yosemite Valley Subbasin (Bulletin 118 Basin Number 5-69) in Yosemite National Park, no DWR-designated groundwater basins are located east of Merced County to the crest of the Sierra Nevada range throughout the entire mountainous zones (Sierra Nevada range) of the San Joaquin River Hydrologic Region. Therefore, the bulk of supplies in counties such as Tuolumne, Mariposa, and Madera derive from fluvial (creek and river) and fractured rock systems, and water systems in these mountainous areas must be managed in a dramatically different manner from the Merced Region. In addition, the type of modeling needed to assess a water system in a mountainous watershed is entirely different from that required for watersheds dominated by a groundwater/alluvial basin setting.

Distinct Land Use Patterns. Land use patterns in the mountainous areas to the east of the Merced Region are dominated by national forest and timber, recreation, tourism, and rangeland grazing of forested areas in the lower foothills. Significant portions of the land areas to the east of the Merced Region boundary are controlled at the federal level as National Parks, National Forests, and Bureau of Land Management areas. The balance of land area in the mountainous areas to the east of the Merced Region is controlled by private entities and local agencies.

Unique Water Management Needs and Challenges. West of the San Joaquin River and adjacent to the Merced Subbasin lies the Delta-Mendota Subbasin (Bulletin 118 Basin Number 5-22.07). The Delta-Mendota Subbasin is unique due to the composition of the contributing parent/alluvial materials and reliance on imported water sources such as the Delta-Mendota Canal (DMC) and State Water Project (SWP). The Subbasins on the west side of the San Joaquin River from the Sacramento-San Joaquin Delta (Delta) to Mendota Pool have significantly different characteristics than the Merced Subbasin, including differences in hydrogeology, land use, water use patterns, and water quality issues. There are also localized water quality concerns, including areas with high levels of iron, fluoride, nitrate, boron, selenium, and salts in the Delta-Mendota Subbasin. As such, this area has different water management challenges and needs than the Merced Region, and is appropriately covered by a different IRWM region.

2.2 Neighboring Regions

The Merced Region is located within the San Joaquin River Funding Area, which contains ten IRWM Regions completely or in part. The eastern border of the Merced Region aligns with the boundary of the San Joaquin River Funding Area (though not exactly). Five IRWM planning regions are immediately adjacent to the Merced Region: the Madera Region, the Yosemite-Mariposa Region, the East Stanislaus Region, the Tuolumne-Stanislaus Region, and the Westside-San Joaquin Region (Figure 1-1).

During the RAP process, the Merced Region sent letters to neighboring RWMG representatives expressing the Merced Region's interest in entering into a Memorandum of Understanding (MOU) or other letter agreement outlining areas of cooperation with its neighboring regions. While MOUs between the IRWM regions have not been established, participants from the Merced Region have been coordinating with members of neighboring regions. Coordination with neighboring regions has increased over time as the governance structures have become more formal. Coordination has also occurred through Funding Area-wide programs, such as the IRWM Disadvantaged Community Involvement Grant program. Inter-regional coordination is discussed in more depth in Chapter 15, Coordination.

2.3 Watersheds and Water Systems

The Merced Region falls within the San Joaquin River Hydrologic Region (equating to the San Joaquin River Funding Area), which is generally the northern portion of the San Joaquin Valley. The San Joaquin Valley is a structural trough up to 200 miles long and 70 miles wide. It is filled with up to 32,000 feet of marine and continental sediments deposited during periodic inundation by the Pacific Ocean and by erosion of the surrounding mountains, respectively.

The San Joaquin River Hydrologic Region includes all of the San Joaquin River drainage area extending south from the southern boundaries of the Delta. It includes the northern drainage of the San Joaquin River main stem in Madera County and its southern drainage in Fresno County. The San Joaquin River is the principal river of the region and all other streams of the hydrologic unit are tributary to it, including the streams of the Merced Region.

2.3.1 Groundwater Basins

Basin and subbasin designations by DWR were first published in 1952 in *California's Groundwater*, DWR Bulletin 118, and subsequently updated in 1975, 1980, 2003, and 2016. Bulletin 118 data provides the primary source of hydrogeologic information for the Region. The San Joaquin River Hydrologic Region contains 11 distinct subbasins including three that underlie the Merced Region: Merced Subbasin (Bulletin 118 Basin Number 5-22.04), Turlock Subbasin (Bulletin 118 Basin Number 5-22.03) and Chowchilla Subbasin (Bulletin 118 Basin Number 5-22.04). Along the southwestern edge of the Merced Region, the Delta-Mendota Subbasin (Bulletin 118 Basin Number 5-22.07) occasionally overlaps with the Merced Region due to minor boundary differences. Because the extent of this overlap is extremely small, the Delta-Mendota Subbasin is not discussed further in this Plan.

The Merced Subbasin includes lands south of the Merced River between the San Joaquin River on the west and the crystalline basement rock of the Sierra Nevada foothills on the east. The subbasin boundary on the south stretches westerly along the Madera-Merced County line (Chowchilla River) and then between the boundary of the Le Grand-Athlone Water District and the Chowchilla Water District (CWD). The boundary continues west along the northern boundaries of CWD and the southern portion of the MID. The southern boundary then rejoins the County boundary along the Chowchilla River continuing west until it meets the

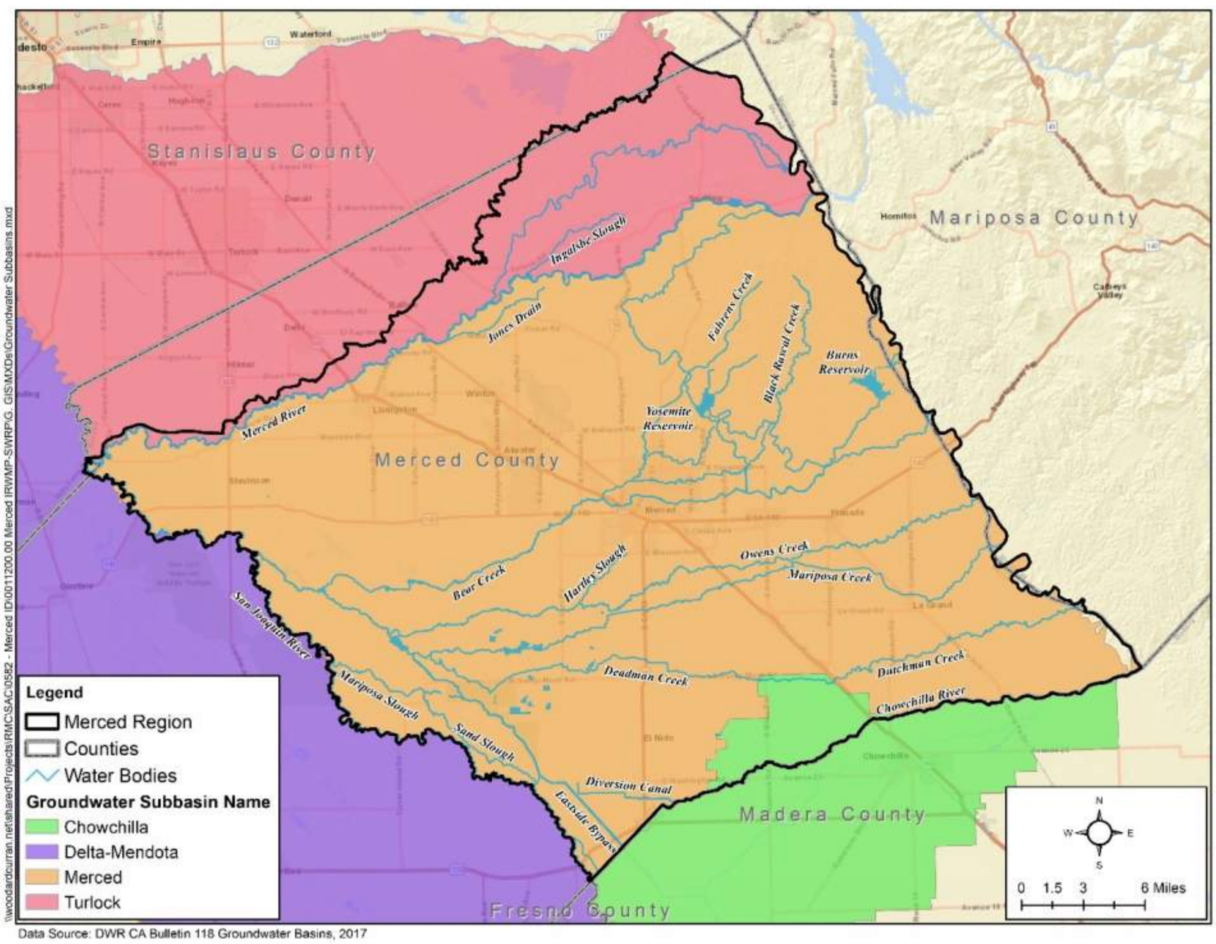
San Joaquin River. Geologic units in the Merced Subbasin consist of consolidated rocks and unconsolidated deposits. The whole of the Merced Subbasin is encompassed by the Merced Region.

There are three groundwater aquifers in the Merced Subbasin: an unconfined aquifer, a confined aquifer, and an aquifer in consolidated rocks. The unconfined water body occurs in the unconsolidated deposits above and east of the Corcoran Clay, which underlies the western half of the subbasin at depths ranging from about 50 to 200 feet, except in the western and southern parts of the area where clay lenses occur and semi-confined conditions exist. The confined aquifer occurs in the unconsolidated deposits below the Corcoran Clay and extends downward to the base of fresh water. The aquifer system in consolidated rocks occurs under both unconfined and confined conditions.

The Chowchilla Subbasin lies to the south of the Merced Subbasin. Its western boundary is the San Joaquin River; to the east, the Subbasin roughly follows the Chowchilla Water District boundaries. The Merced Region encompasses the portion of the Chowchilla Subbasin that falls north of the Chowchilla River.

The Turlock Subbasin lies to the north of the Merced Subbasin. It includes land between the Tuolumne and Merced Rivers. Like the Merced Subbasin, which borders the Turlock Subbasin to the south, the Turlock Subbasin is bounded on the west by the San Joaquin River and on the east by crystalline basement rock of the Sierra Nevada foothills. Groundwater flow is primarily to the southwest. The primary hydrogeologic units in the Turlock Subbasin include both consolidated and unconsolidated sedimentary deposits. The Merced Region encompasses portions of the Turlock Subbasin, mainly the portion that underlies the Dry Creek watershed.

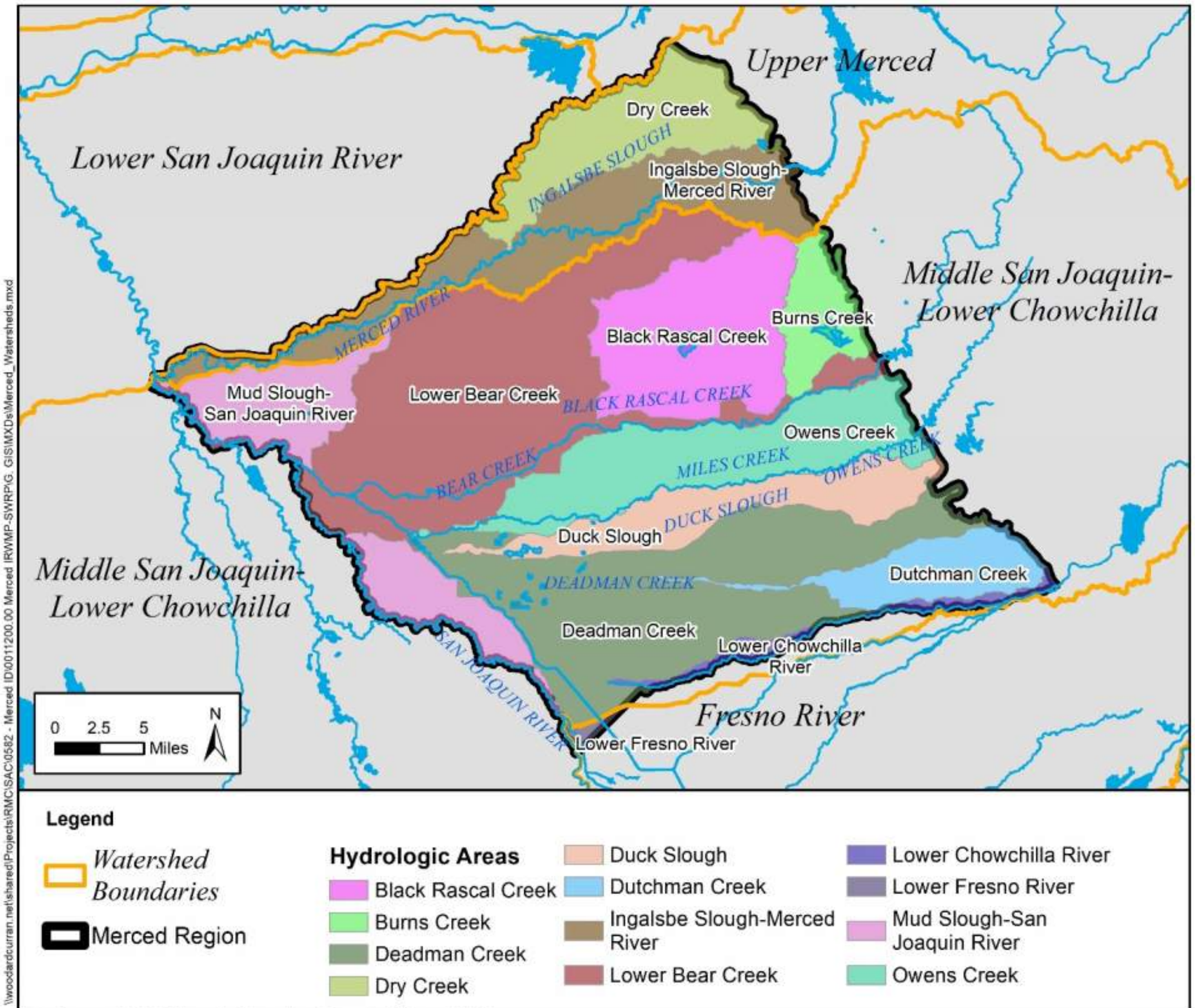
Figure 2-2: Groundwater Subbasins



2.3.2 Watersheds

Watersheds defined by both the California Department of Conservation through the California Watershed Portal and the U.S. Geological Survey (USGS) Watershed Boundary Dataset were reviewed in defining the watersheds of the Merced Region. The USGS Watershed Boundary Dataset classifications (Figure 2-3) were selected as more representative of the Merced Region because watershed boundaries are determined solely upon hydrologic principles and do not favor any administrative boundaries. Based on USGS cataloging (HUC 8-digit boundaries), the Region lies mainly within the Upper Merced and Middle San Joaquin-Lower Chowchilla Watershed with a very small portion of the Region in the Fresno River Watershed. Each of these watersheds is subdivided into smaller hydrologic areas. The Merced Region overlies the following hydrologic areas: Lower Chowchilla River, Dutchman Creek, Duck Slough, Deadman Creek, Owens Creek, Burns Creek, Black Rascal Creek, Lower Bear Creek, Ingalsbe Slough-Merced River, Mud-Slough-San Joaquin River and Dry Creek. These hydrologic areas are named after the numerous rivers and creeks within the Region, which include the Chowchilla River, Merced River, San Joaquin River, Dutchman Creek, Deadman Creek, Canal Creek, Fahrens Creek, Miles Creek, Owens Creek, Burns Creek, Black Rascal Creek, Bear Creek and Dry Creek.

Figure 2-3: Watersheds within the Merced Region

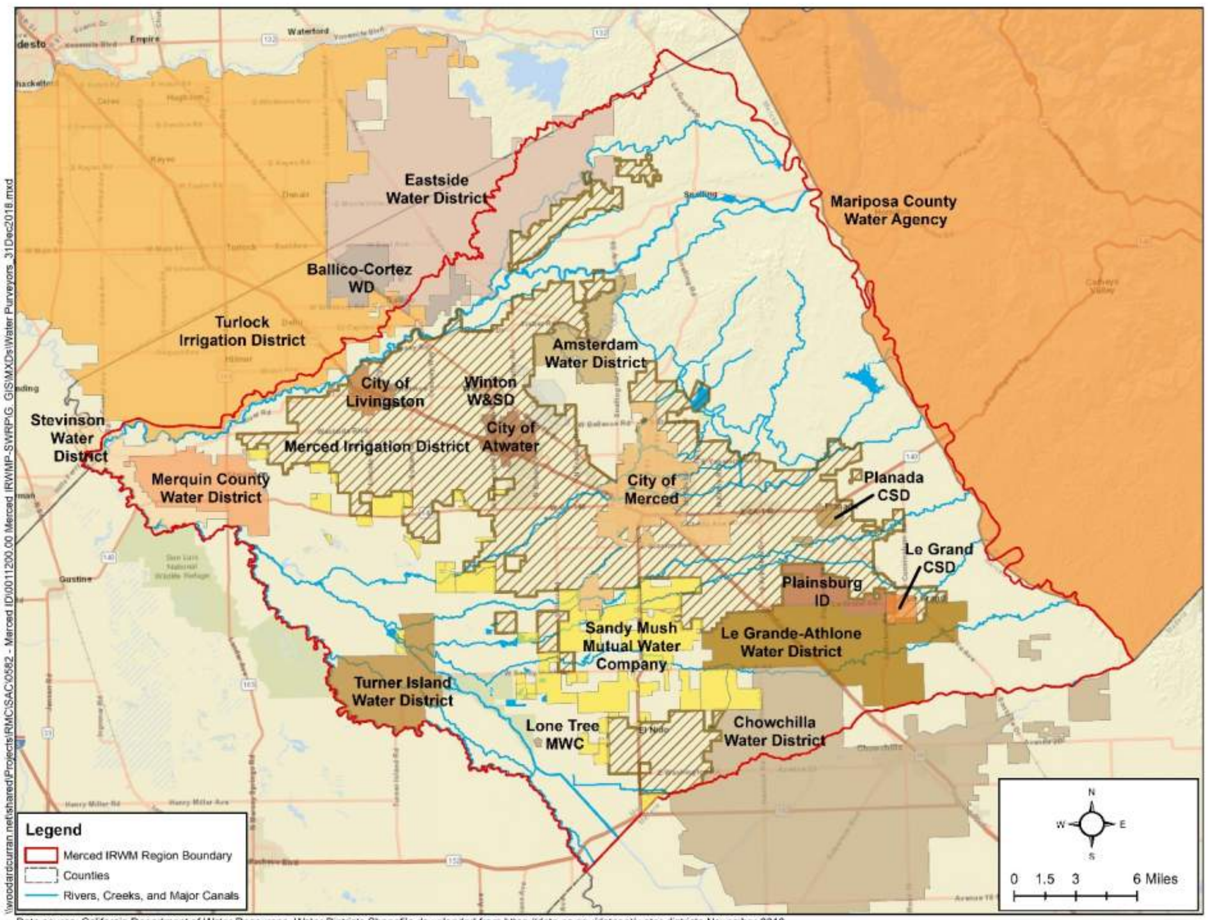


Data Source: USGS Watershed Boundary Dataset, HU8 and HU10

2.3.3 Water Supply Systems and Distribution

Numerous agencies and organizations supply water throughout the Merced Region, as shown in Figure 2-4. Domestic water systems within the unincorporated portions of Merced County are generally small, independent systems providing water to individual communities. Most of the unincorporated areas outside of major communities are designated for agricultural use and receive their water supply from individual groundwater wells; however, agricultural water supply systems also exist to serve irrigation users. Agencies providing domestic and irrigation water services to the unincorporated areas of Merced County and within the Region (eastern Merced County) are shown in Table 2-1.

Figure 2-4: Water Supply Entities within the Region



Data source: California Department of Water Resources, Water Districts Shapefile downloaded from https://data.ca.gov/dataset/water-districts November 2018.

Table 2-1: Agencies Providing Water Service to Unincorporated Areas of the Merced Region

Agencies Providing Water Service to Unincorporated Areas in the Merced Region	
Public Water Supply Agencies	
Municipal	*Agricultural*
Le Grand Community Services District	Chowchilla Water District
Planada Community Services District	East Side Water District
Winton Water and Sanitary District	Le Grand - Athlone Water District
	Merced Irrigation District
	Merquin County Water District
	Plainsburg Irrigation District
	Stevinson Water District
	Turlock Irrigation District
	Turner Island Water District
Private Water Companies	
Municipal	*Agricultural*
California American Water Company – Meadowbrook District	Lone Tree Mutual Water Company
	Sandy Mush Mutual Water Company

In addition to water systems within unincorporated areas of the Region, separate domestic systems are provided to the residents of the incorporated cities of Merced, Livingston, and Atwater. Services provided by the Region's incorporated cities, in addition to other major water suppliers in the Region, are described in the following sections.

Municipal Water Suppliers

The following municipal water suppliers provide services to the Region.

- City of Atwater
- City of Livingston
- City of Merced
- Le Grand Community Services District
- Meadowbrook District of California American Water Company
- Planada Community Services District
- Winton Water and Sanitary District

Information on each supplier is provided below.

City of Atwater

The City of Atwater provides domestic water service to a growing population. According to the 2010 U.S. Census, the population of Atwater grew by almost 22% from 2000 to 2010, reaching 28,168 in 2010. Since then, growth has slowed; the population was estimated at 29,397 residents in 2017 (U.S. Census Bureau, 2018a). The City of Atwater operates a municipal water system that utilizes local groundwater wells in the Merced Subbasin to provide water to the city's residents. Historically, the City of Atwater has not treated groundwater prior to delivering it to customers, with the exception of chlorine injection as required by the State of California. The City's municipal water system consists of 11 wells. As of May 2018, the City of Atwater experienced elevated concentrations of 1,2,3-trichloropropane (TCP) in its water system. The City is working with the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) to correct the problem and is required to bring the system into compliance by 2021. In terms of supply volume, in 2016, the City of Atwater pumped approximately 8,961 acre-feet (AF) (or an average of 8 million gallons per day [mgd]) of water from the Merced subbasin, which constituted the entire water supply for the city (EMC Planning Group, 2016).

City of Livingston

The City of Livingston provides water supplies to its residents, which numbered approximately 14,140 in 2017 (based on Census estimates). The sole source of water supply for the City of Livingston is groundwater from the Merced Subbasin, which is pumped from eight groundwater wells that have a combined capacity of 12.8 mgd (AM Consulting Engineers, 2016). Dibromochloropropane (DBCP) and nitrates have both been detected in city wells, but both constituents are currently below the maximum contaminant level (MCL) and treatment is not required. To combat water quality and future restrictions on groundwater under the Sustainable Groundwater Management Act (SGMA), the City is interested in receiving supplemental surface water from MID.

City of Merced

The City of Merced provides water supplies primarily to residential users, which included approximately 84,000 people in 2015 (Carollo, 2017). The City's population is projected to continue to increase, reaching approximately 140,000 in 2035 (Carollo, 2017). In addition to residential users, the City of Merced also supplies water to commercial/institutional, industrial, and landscape irrigation users.

The City of Merced's sole water supply source is groundwater from the Merced Subbasin, which is pumped from 19 active groundwater wells that are scattered throughout the City's service area. One of the City's groundwater wells is impacted by water quality issues associated with arsenic. Although the City of Merced's existing water supplies are provided solely from groundwater sources, the City anticipates using a small amount of surface water from MID to supplement its water supply in the future. A portion of such supply could be provided by MID in exchange for recycled water from the City. MID's deliveries to the City are initially expected to be roughly 60 acre-feet per year (AFY) (in 2020), rising to 15,000 AFY in 2030 (MID staff, Carollo, 2017).

Le Grand Community Services District

The Le Grand Community Services District (CSD) provides domestic water service to residents in the unincorporated community of Le Grand, located in the eastern portion of the Region. The community of Le Grand has a population of approximately 1,721 according to 2012-2016 Census estimates (U.S. Census Bureau, 2017) and is located in eastern Merced County, approximately 12 miles southeast of the City of Merced. Municipal water is supplied to the community of Le Grand by three groundwater wells in the Merced Subbasin capable of producing 1.8 mgd. According to the 2016 Merced County General Plan Land Use Element, average annual water use in Le Grand is 1,075 AFY (0.96 mgd).

Meadowbrook Water Company/California American Water

Meadowbrook Water Company was founded in 1955 to serve a small subdivision in what is now known as the Franklin-Beachwood area. Most of the land in the Meadowbrook service area was originally agricultural land and dairy farms. In recent years, many farmers have subdivided their land and some of the dairies closed down with subdivisions constructed in their stead. In 2017, California American Water acquired Meadowbrook Water Company, and now owns and operates the area's water infrastructure, supplying groundwater from the Merced Subbasin to approximately 1,700 homes and businesses (Business Wire, 2017).

Winton Water and Sanitary District

The Winton Water and Sanitary District (WWSD) serves water to the unincorporated community of Winton and its surrounding area, located north of the City of Atwater. According to 2012-2016 American Community Survey (ACS) 5-year population estimates (the most up-to-date data available), the population of the community of Winton was 11,309 (U.S. Census Bureau, 2017). WWSD provides water services to approximately 2,982 connections, supplying an annual average of approximately 1,748 AFY (1.56 mgd), which is pumped from the Merced Subbasin (Merced County, 2016).

Planada Community Services District

The Planada CSD provides domestic water service to residents in the unincorporated community of Planada. Planada is located in eastern Merced County along State Route 140. According to 2012-2016 ACS 5-year population estimates (the most up-to-date data available), the community of Planada has a population of 4,499 (U.S. Census Bureau, 2017). Municipal water is obtained from the Merced Subbasin via six groundwater wells with a production capacity of 4.32 mgd. Groundwater is chlorinated prior to conveyance through a pressurized system. In 2012, Planada CSD produced 1,205 AFY (or an average of 1.08 mgd).

Agricultural Water Suppliers

The following agricultural water suppliers provide services to the Region.

- Chowchilla Water District
- East Side Water District
- Le Grand – Athlone Water District
- Lone Tree Mutual Water Company
- Merced Irrigation District
- Merquin County Water District
- Plainsburg Irrigation District
- Sandy Mush Mutual Water Company
- Stevinson Water District
- Turlock Irrigation District
- Turner Island Water District

Information on each supplier is provided below.

Chowchilla Water District

CWD, formed in 1949, serves portions of both Merced County and Madera County and therefore is only partially located within the Merced Region. In total, CWD serves approximately 85,000 total acres of agricultural land, including over 400 water users (CWD, 2017).

CWD receives water from the Central Valley Project (CVP) via the Madera Canal and the Buchanan Dam. This water is conveyed to irrigation users through CWD's water distribution system which consists of 150 miles of unlined canals and 49 miles of pipeline. Between 2004 and 2013, CWD supplied an average of 141,412 AFY to its customers (CWD, 2017). In 2015, CWD supplies fell to 527 AF as a result of drought, which caused reduced CVP allocations (CWD, 2015).

Eastside Water District

The Eastside Water District (EWD) is located partially in the East Stanislaus IRWM Region and partially in the Merced Region; in total, it comprises 61,293 acres (Woodard & Curran, 2018). It occupies most of the Dry Creek Watershed on the valley floor. The EWD does not directly supply water; it was formed as a cooperative effort by landowners to manage groundwater resources. Landowners within the Eastside Water District area rely predominantly on groundwater pumped from the Turlock Subbasin (roughly 160,000 AFY [Woodard & Curran, 2018]), although in wet years limited amounts of water may be purchased from Turlock Irrigation District and MID (Eastside Water District, 2015).

Le Grand–Athlone Water District

The Le Grand–Athlone Water District provides water service south of the community of Le Grand, up to the border of the CWD. The Le Grand–Athlone Water District distributes water purchased from MID when available. In 2012, the Le Grand–Athlone Water District served approximately 322 AF of water from groundwater sources.

Lone Tree Mutual Water Company

Lone Tree Mutual Water Company (LTMWC) is a private water company that provides water for agricultural irrigation uses in the El Nido area. The majority of its water supply (73%) comes from groundwater; the remaining water comes from a combination of surface supplies diverted from the Eastside Bypass and recirculated tail and tile water (LTMWC, 2016). In total, LTMWC covers 12,718 acres; of this, 11,574 acres are irrigable agriculture (LTMWC, 2016). LTMWC's supply infrastructure includes approximately 17 miles of canals (mostly unlined), 23 miles of drains,16 miles of pipelines, and 94 wells (LTMWC, 2016). From 2007 to 2015, LTMWC delivered an average of 33,179 AFY of groundwater (pumped from the Merced Subbasin) and 12,130 AFY of surface water (LTMWC, 2016).

Merced Irrigation District

MID, formed in 1919, is a regional water supplier that supplies water to users within its service area. In addition, MID also delivers water to satisfy other entitlements, and provides water to irrigators located outside of the MID service area. MID sells water, as supplies are available, to the following areas within the Merced Region:

- Merced Union High School (landscape application only)
- Le Grand-Athlone Water District
- Chowchilla Water District
- Unincorporated areas within MID's Sphere of Influence

In addition, MID fulfills water commitments to:

- Cowell Agreement Diverters, encompassing an area in excess of 20,000 acres in the Merced River valley between Snelling and Oakdale Road
- Stevinson Water District
- Various riparian and appropriated water users in Merced River and thorough MID system
- Merced National Wildlife Refuge

MID has made deliveries under various water transfers mainly for agricultural and environmental purposes, such as transfers to:

- DWR for instream flows under Davis Grunsky contract since 1967
- Lands within MID Sphere of Influence
- U.S. Bureau of Reclamation (USBR) and DWR for river instream flows under Vernalis Adaptive Management Plan between 1999 and 2011
- The Environmental Water Account
- Westlands Water District

- Delta Mendota Water Authority
- Kern County Water Agency and Dudley Ridge
- San Luis Wildlife Refuge – East Bear Creek unit

MID also provides irrigation water to eastern Merced County's agricultural land. MID's service area covers 164,000 acres, which includes approximately 133,000 acres of irrigated farmland (MID, 2016). Approximately 320,000 AF of water per year is distributed through 790 miles of canals and pipelines (MID, 2016). MID possesses pre-1914 diversion and storage rights from the Merced River and local streams. In addition, MID possesses a number of SWRCB water licenses from Merced River, Mariposa Creek and Deadman Creek. Lake McClure is MID's principal water storage reservoir and has a capacity of approximately 1,025,000 AF (MID, 2016).

Merced Water Supply Plan

MID conducts long-term water supply planning via documents such as the Merced Water Supply Plan, which is summarized in the following paragraphs. The Merced Water Supply Plan, completed in 1993 and updated in 2001, provides a general plan for overall water system expansion and recommendations for managing the water supply for the study area. The Water Supply Plan Update was prepared by the City of Merced and MID in conjunction with the University of California, Merced (UC Merced). The Water Supply Plan identified five goals:

- Manage groundwater resources;
- Provide a high-quality, reliable supply of water for cities;
- Protect and enhance the economic base;
- Protect MID's Merced River water rights; and
- Maintain consensus on a water supply plan.

The Water Supply Plan Update identified water needs and planning scenarios through the year 2040 for the study area, which includes 582,000 acres located in eastern Merced County and closely follows the Merced Subbasin. Historical water data showed that the use of surface water supplied by MID decreased in the Region, while groundwater pumping for irrigation rose. The change was attributed to five years of extended drought in the late 1980s and a lack in technological advancement for filtering surface water to levels adequate for sprinkler and drip systems, making groundwater more desirable. The Water Supply Plan Update outlined potential consequences that could occur if aquifer levels continue to decline, including land subsidence, reduction of drought protection, imposition of regulatory control, higher energy usage and costs, and reduction in agricultural production (CH2M Hill, 2001).

The Water Supply Plan Update also identified numerous planning scenarios to address future conditions and to achieve program goals. Common solutions were identified among the planning scenarios and developed into a base level of solutions for immediate response, including the following.

- Intentional recharge site investigations
- Incentives and related system improvements
- Surface water conservation and automation
- Agricultural capacity improvements
- Urban water conservation
- Urban groundwater to surface water conversion
- Participation in water rights issues
- Institutional program establishment

Other potentially costlier solutions may be required if specific "triggers" occur. For example, future regulatory actions on the Merced River may trigger the need for drought relief wells. As a next step, the Water Supply Plan Update recommended formation of a committee to identify beneficiaries of program implementation and to allocate costs accordingly.

Merquin County Water District

Merquin County Water District services approximately 9,000 acres of in-District farmland with 14,281 AF of surface water supplied by Stevinson Water District / Eastside Canal and 8,000 AF of well water supplied by Merquin County Water District.

Stevinson Water District

Stevinson Water District (SWD) serves a small area of approximately 3,600 acres in the northwest corner of the Region that abuts Merced River and the San Joaquin River, along the southeasterly banks of their confluence (Economic and Planning Systems, Inc., 2008). Stevinson Water District holds appropriative and adjudicated water rights to divert from the rivers and local streams. The District owns, operates and maintains the East Side Canal, a feature that can intercept flows from all Merced Streams (Bear Creek, Owens Creek, Mariposa Creek, and Deadman Creek) and their tributaries. SWD receives approximately 26,400 AF annually from MID per an adjudicated agreement between the districts (MID, 2016). SWD provides surface water to agricultural users that lie south and west of the unincorporated community of Stevinson. SWD also delivers water to Merquin County Water District (Economic and Planning Systems, Inc., 2008).

Turlock Irrigation District

A small portion of Turlock Irrigation District (TID) is located within the Region north of the Merced River and west of the confluence of Dry Creek and the Merced River. TID receives its surface water flows from the Tuolumne River. From 2010 to 2014, TID supplied an average of approximately 604,000 AFY, approximately 75% from surface water, 22% from groundwater and 3% from other supplies such as subsurface drainage, tailwater, spill recovery, and recycled wastewater (TID, 2015).

Turner Island Water District

Turner Island Water District (TIWD), a California Water District, is located in the Turner Island area of Merced County. Situated along the San Joaquin River, TIWD is comprised of approximately 12,000 total acres split between the Delta-Mendota Subbasin and the Merced Subbasin. TIWD serves water to approximately 8,000 acres of farmland consisting of primarily row crop farming (cotton, tomatoes, wheat, melons, alfalfa, corn and vegetable crops), native and irrigated pasture, cattle grazing, and duck club/wetland habitat. TIWD delivers, on average, approximately 25,000 AFY of water of which approximately 50% is from surface water sources and 50% from groundwater pumping (L. Harris, personal communication, August 16, 2018). Historical surface water deliveries typical come from San Luis Canal Company, Eastside Canal Company, MID, and flood flows in the Eastside Bypass.

Plainsburg Irrigation District

Plainsburg Irrigation District (PID) is located to the southwest of the community of Planada. PID supplies groundwater to land owners in the area and purchases some surface water from MID when available.

Amsterdam Water District

Amsterdam Water District is a newly created water district located along Canal Creek, northwest of the City of Merced. Amsterdam Water District is mostly confined between Canal Creek and Hwy 59, and encompasses roughly 6,600 acres.

Sandy Mush Mutual Water Company

Sandy Mush Mutual Water Company covers a range of disconnected areas within the Merced Region, with the largest portions lying south of the City of Merced. In total, Sandy Mush Mutual Water Company covers approximately 29,000 acres.

Inactive Water Agencies

Sierra Water District is an inactive water district located at the southwesterly corner of the Region; land owners in the district service area rely on groundwater for supply. Subsidence has occurred within the area, which is of special interest to the Region.

2.3.4 Wastewater

Most of the sanitary sewer systems within the unincorporated areas of the Region serve individual small communities. Sanitary sewer service within the unincorporated County portions of the Region is generally provided by special districts including CSDs, public utility districts, sanitary districts, and sewer maintenance districts. Some agencies provide sewer collection service only and contract with surrounding agencies for wastewater treatment and disposal. Some of the unincorporated communities of Merced County lack sanitary sewer infrastructure and are serviced by individual or community septic systems. Areas within the Region currently lacking sanitary sewer infrastructure are listed below.

- Cressey
- El Nido
- Stevinson
- Tuttle
- Celeste (portions of the community are served by the City of Merced)

Most of the unincorporated areas outside of major communities are designated for agricultural use and discharge wastewater through onsite wastewater treatment systems. In areas serviced by individual or community systems, property owners are generally responsible for maintenance and improvement.

The paragraphs to follow describe the current state of sewer infrastructure in the Region:

- City of Atwater
- City of Livingston
- City of Merced
- Franklin County Water District
- Le Grand CSD
- Planada CSD
- Snelling CSD
- Winton CSD

City of Atwater

The City of Atwater provides wastewater collection and treatment services within its service area. In 2005, all of the city's wastewater flows were beneficially reused and recycled through land disposal. Land disposal includes application at a local farm for irrigation purposes and use by the U.S. Fish and Wildlife Service (USFWS) for wetland habitat.

The City of Atwater collects and treats approximately 3.4 mgd of wastewater, or approximately 3,800 AFY, and has an average flow capacity of 6.0 mgd. The City constructed a new wastewater treatment plant approximately 6 miles south of Atwater, which became operational in 2013. Wastewater is collected through a network of sanitary sewer collection pipelines and fed by gravity to the City's wastewater treatment plant via 18 sewer pump stations. After treatment at the City's wastewater treatment plant, treated effluent is conveyed from the Atwater Drain to land disposal methods explained above. In addition, solids generated at the wastewater treatment plant are dried and applied to one of several permitted sites in Merced County that are used to grow hay.

City of Livingston

The City of Livingston provides sanitary sewer service within its service area, including a collection system of mains, manholes, service laterals, pump stations, and trunk sewer mains that are used to convey wastewater to the City's domestic wastewater treatment plant, which has the capacity to treat an average daily maximum month flow of 2.0 mgd. Treated effluent from the City's domestic wastewater treatment plant is sent to percolation ponds and lined sludge drying beds. Currently, effluent is not reclaimed. The City plans to expand treatment capacity in the future to 4.0 mgd in order to accommodate population growth, but a timeframe for this work has not yet been established (Economic & Planning Systems, 2018).

Historically, the City of Livingston also operated an industrial wastewater treatment plant that was used to treat flows from a private poultry processing plant. The poultry plant now treats its own wastewater onsite, and the City is in the process of decommissioning its old industrial wastewater treatment plant.

City of Merced

In addition to providing water supply within its service area, the City of Merced is also responsible for collecting, treating, and disposing of wastewater. Currently, all treated effluent from the City of Merced wastewater treatment facility is discharged through a gravity channel to Hartley Slough, to a Food Processing and Land Application Area (FPLAA) owned by the City, and to a wildlife management area wetland. Treated effluent that is conveyed to the Hartley Slough and the FPLAA is used for agricultural irrigation purposes, while the water that is conveyed to the wildlife management area wetland is used to create a series of percolation and evaporation ponds.

As of 2014, the City of Merced is permitted to produce disinfected tertiary effluent (CVRWQCB, 2014) at its wastewater treatment plant in accordance with Title 22 of the California Code of Regulations. Wastewater generated within the City is conveyed to the City's wastewater treatment plant. The wastewater is screened and rocks and sand are removed. It is then pumped to primary clarifiers that allow any particles in the water to settle. Wastewater then flows to aeration basins where bacteria consume organic material and secondary clarifiers are used to settle out the bacteria. Secondary effluent is chemically conditioned, filtered, and disinfected with ultraviolet light. The treated water is then aerated prior to discharge into Hartley Slough. After final treatment, the water is suitable for unrestricted reuse for agriculture purposes. The waste solids, or sludge, is digested and dried so the material can be applied as a soil amendment.

The City will continue to provide treated effluent to the Hartley Slough, FPLAA, and the wildlife management area wetland, and does not currently plan to distribute recycled water. The quantity of treated effluent conveyed to these three areas is anticipated to increase substantially compared to current levels. In 2015, the City treated 7,539 AF of wastewater. Of this, 2,653 AF was discharged to Hartley Slough. 2,670 AF was used for agricultural irrigation, and 2,215 was conveyed to wetlands and wildlife habitat. The City estimates that recycled water use for agricultural irrigation will increase to 3,500 AFY by 2035 (Carollo, 2017).

Franklin County Water District

Franklin County Water District (FCWD) provides sanitary sewer collection and treatment services to residents in the unincorporated community of Franklin-Beachwood. FCWD owns and operates a wastewater treatment facility located on the eastern side of the community. The community wastewater treatment facility consists of headworks with a bar screen, an aerated pond with two aerators, and eight evaporation/percolation ponds totaling 30 acres. The wastewater treatment facility is operated in accordance with Waste Discharge Requirements Order (WDR Order) No. 89-171 (CVRWQCB, 1989). FCWD serves approximately 650 connections. The total system capacity is 0.6 mgd; the average wastewater flow is 0.371 mgd (Economic and Planning Systems, Inc., 2007).

Le Grand Community Services District

In addition to domestic water service, the Le Grand CSD also provides sanitary sewer collection and treatment services to the community of Le Grand. Le Grand CSD owns and operates a wastewater treatment facility located southwest of the community of Le Grand.

The expanded wastewater treatment facility is operated in accordance with WDR Order No. 97-053 (CVRWQCB). The facility consists of a headworks with a mechanically-cleaned bar screen and screenings press, two partially-mixed aerated lagoons with surface aerators, and one stabilization pond. Disposal is to two evaporation/percolation ponds and a 37-acre reuse area of fiber, fodder, and seed crops. Sludge removed from the ponds is also applied to the reuse area. According to the Order adopted by the Central Valley Regional Water Quality Control Board (CVRWQCB), the capacity of the wastewater treatment facility is 0.35 mgd. The stabilization pond was designed in a manner that will allow a future increase in capacity to 0.50 mgd. The average wastewater flows in 2004-2005 were 0.15 mgd (Merced County, 2016).

Planada Community Services District

In addition to domestic water service, Planada CSD provides sanitary sewer collection and treatment services to the community of Planada. Planada CSD owns and operates a wastewater treatment facility located to the southwest of the community.

As of 2015, Planada CSD provided wastewater service to 1,181 connections (Economic and Planning Systems, Inc., 2015). An order by the CVRWQCB required Planada CSD to abandon their old treatment plant and construct a new plant. Construction began on the new plant in 2015 and was completed in April 2017 (D. Chavez, personal communication, August 14, 2018). The new treatment plant has a capacity of 0.58 mgd and includes capacity for the entire service area (Economic and Planning Systems, Inc., 2015). Improvements include new wastewater treatment facility headworks, treatment pond expansion and upgrades, and a new effluent pump station, and storage ponds. Rather than discharging effluent to Miles Creek as in the past, the treated wastewater will be used to irrigate crops.

Snelling Community Services District

Snelling CSD was formed in 1974 and provides wastewater services only. It has a service area of approximately 480 acres centered on the community of Snelling and serving 115 sewer connections. It has a wastewater treatment plant with a maximum capacity of 60,000 gallons per day (gpd), and the district has a policy that it will not exceed 75 percent of the maximum capacity to provide capacity for emergency situations. Average flows to the plant are approximately 31,000 gpd (Economic and Planning Systems, Inc., 2007).

Winton Water and Sanitary District

Currently, Winton Water and Sanitary District collects wastewater from approximately 3,000 connections; the District discharges raw wastewater to the City of Atwater for treatment and disposal. A treatment facility feasibility study was completed for the Castle Airport/Winton Area by Merced County in 2007. The feasibility study was prompted by an implementation plan proposed by the Merced County Department of Commerce Aviation and Economic Development. The implementation plan is designed to fully utilize the resources of the former Castle Air Force Base (now designated as Castle Airport). The recommended alternative in the feasibility study was a 3.0 mgd tertiary treatment plant to serve the 1,600-acre Castle Airport and approximately 800 acres within the unincorporated area of the Winton Water and Sanitary District. The treatment facility would discharge treated effluent into the Casad Lateral Canal in the summer with effluent applied to on-site percolation ponds in the winter. As of summer 2018, this project has not progressed past the feasibility study stage (B. Wey, personal communication, August 14, 2018).

2.3.5 Recycled Water

As discussed previously, wastewater collection and treatment in the Region is generally provided by special districts within the unincorporated areas of Merced County and by the cities of Merced, Atwater, and Livingston.

The Cities of Merced and Atwater both currently reuse treated wastewater effluent for agriculture. The City of Merced's wastewater treatment plant currently treats wastewater to disinfected tertiary levels in accordance with Title 22 of the California Code of Regulations. As such, wastewater from the City of Merced can be used for industrial and irrigation uses in accordance with Title 22. According to the City of Merced's 2015 Urban Water Management Plan (UWMP), the City's recycled water program is in its early stages with water being used within the Public Works Collections Department (Carollo, 2017). The City expects agricultural use of recycled water to increase slightly over time. The City of Merced and MID are investigating trading MID surface water for recycled water from the City of Merced. Recycled water would be applied over areas serviced by MID, and in exchange, MID would provide surface water to various parks and landscape areas in the City that can be served by MID facilities that still traverse the City. This effort would avoid the need to install more than 12 miles of pipeline and multiple pumps and is in compliance with Merced Groundwater Management Plan Update recommendation to defer recycled water use in areas upstream from the wastewater treatment plant. Wastewater treated by the City of Atwater does not adhere to standards established by Title 22 of the California Code of Regulations, and therefore cannot be used for expanded recycled water uses. The City of Livingston has evaluated the use of recycled water and determined that water recycling is not cost effective for the City at this time.

2.3.6 Water Conservation

In response to declining groundwater levels in the Merced Subbasin, water supply entities in the Region are working to implement programs to maintain groundwater levels, including conservation programs. Conservation efforts are often influenced by factors such as supply availability and regulatory guidelines. Supply availability and regulatory constraints faced by the Region when shaping water conservation programs, and conservation measures that the Region is currently implementing, are summarized below.

Supply Availability

Groundwater is a primary source of water supply and the sole supply of potable water for many in the Region. Each city within the Region operates groundwater wells that pump from the Merced Subbasin. Water conservation is vital to prevent overdraft or other adverse impacts to the groundwater basin.

The City of Merced and MID are currently planning to introduce the use of surface water from MID for landscape irrigation. The Cities of Livingston and Atwater plan to continue to use groundwater as their sole source of water supply. However, as surface water is further introduced as an alternative supply to groundwater, effective conjunctive use of surface water and groundwater must be managed. This requires different conservation approaches in areas with adequate surface water supplies as compared to areas with inadequate or no surface water supplies that rely mostly (or solely) on groundwater. Sustainable use of groundwater relies on surface water for recharge of the groundwater storage reservoir. Thus, continued use of surface water must be encouraged to the greatest extent possible. Use of surface water in place of groundwater, known as in lieu recharge, helps maintain groundwater storage by reducing groundwater demand. The City of Livingston is currently investigating the use of surface water for potable use while maintaining the existing groundwater well network for years of surface water shortage (AM Consulting Engineers, 2016).

Regulatory Frameworks

State and federal laws mandate conservation practices help to shape existing conservation programs. Regulations affecting the Region are summarized below:

- **Assembly Bill 1420** (AB 1420) amended the Urban Water Management Planning Act to require implementation of the Water Demand Management Measures (DMMs) and best management practices (BMPs), and meeting the 20x2020 targets to qualify for funding.
- **Assembly Bill 1881** (AB 1881), the Water Conservation in Landscaping Act of 2006, mandated increased water efficiency for both new and existing development statewide. The law required DWR to update the Model Water Efficient Landscape Ordinance (MWELO), which established water management practices and water waste prevention for landscape irrigation needs. Cities can elect to either adopt DWR's MWELO or introduce their own local landscape ordinances. In addition to adopting the MWELO, each city in the Region has its own efforts in place to further reduce irrigation needs. For example, all of Atwater's city-maintained median strips and traffic islands that require plantings are landscaped with drought-tolerant plants. The City of Merced is currently enforcing a local Water Conservation Ordinance that restricts outdoor irrigation to three days a week and only between 9 p.m. and 9 a.m. (City of Merced, 2018).
- **California Water Code § 525-529.5** require that urban water suppliers install water meters on all municipal and industrial service connections on or before January 1, 2025 and charge customers based on the actual volume of deliveries as measured by the water meters. Currently, the City of Merced is fully metered for all customer classes (Carollo, 2017) and the City of Livingston has 97 percent of its accounts metered (City of Livingston, n.d.). The City of Atwater meters new connections and is working to meter existing connections (EMC Planning Group, Inc., 2016).
- **Water Conservation Bill of 2009 (SB x7-7)** was enacted in November 2009, requiring all water suppliers – urban and agricultural – to increase water use efficiency. SBx7-7 sets an overall goal of reducing per capita urban water use by 20 percent by 2020, with an interim goal of reducing per capita water use by at least 10 percent by December 31, 2015. Each urban water supplier must develop its water use target and interim target using one of the four methods established by DWR. According to City of Merced's 2015 UWMP, the City's baseline daily 10-year per capita water use is 310 gallons per capita day (gpcd) and 5-year per capita water use is 282 gpcd (Carollo, 2017). The City of Merced met its 2015 interim target (279 gpcd) and is now on track to meet its 2020 target of 248 gpcd. According to the City of Livingston's 2015 UWMP, the City had a daily per capita water use of 139 gpcd in 2015, achieving their 2015 interim target of 186 gpcd and their

2020 target of 165 gpcd (AM Consulting Engineers, 2016). The City of Atwater has not prepared a UWMP since 2005, so no targets have been established.

SBx7-7 also requires agricultural districts serving over 25,000 acres to implement Efficient Water Management Practices and to prepare and adopt an Agricultural Water Management Plan (AWMP) per new standards. Districts under 25,000 acres are required to produce a plan if they receive State funds. MID completed its AWMP consistent with these standards. LTMWC and CWD have also prepared AWMPs. Other agricultural agencies may follow with their own plans.

Urban Demand Management Measures

The Region's urban water suppliers (the Cities of Merced, Livingston, and Atwater) implement a number of water conservation measures. Table 2-2 summarizes the implementation status of the six primary Demand Management Measures (DMMs), per California Water Code §10631, listed in each of the cities' most recent UWMPs. The City of Merced has Other DMMs that include Residential Plumbing Retrofit Programs, a Washing Machine Rebate Program, Commercial, Industrial, and Institutional Conservation Programs, and a Turf Replacement Initiative. The City of Livingston has Other DMMs that include Residential Plumbing Retrofit Programs and a High-Efficiency Washing Machine Rebate Program.

Table 2-2: Water Conservation Measures Employed in the Region

	Demand Management Measure	City of Merced[1]	City of Livingston[2]	City of Atwater[3]
1	Water Waste Prevention Ordinances	●	○	●
2	Metering	●	●	●
3	Conservation Pricing	●	●	●
4	Public Education and Outreach	●	●	●
5	Programs to Assess and Manage Distribution System Real Loss	○	⃠	●
6	Water Conservation Program Coordination and Staffing Support	●	●	●
7	Other	●	●	⃠

● - Fully or Partially Implemented; ○ - Planned or in Evaluation; ⃠ - Not Implemented; n/a -Not applicable to agency

1. Source: City of Merced 2015 UWMP (Carollo, 2017).
2. Source: City of Livingston 2015 UWMP (AM Consulting Engineers, 2016).
3. Source: City of Atwater 2005 UWMP (Boyle Engineering, 2007). Atwater did not prepare a 2010 or 2015 UWMP.

Agricultural Efficient Water Management Practices

Agricultural water conservation can be defined as reducing the amount of water applied to crops while maintaining or improving crop yield. In 2003, MID completed a *Water Management Plan* in accordance with Assembly Bill 3616 (AB 3616), also known as the Agricultural Water Suppliers Efficient Water Management Practices Act. Building on this effort, MID prepared AWMPs in 2013 and 2015 to comply with SBx7-7. These plans focus on establishment of applicable Efficient Water Management Practices, which include water conservation efforts. Efficient Water Management Practices within MID's existing AWMP that pertain to conservation include water metering, volumetric pricing, and conjunctive use (MID, 2016).

According to the Merced Groundwater Basin Management Plan, in total, MID has implemented various recharge and conservation efforts that have resulted in the cumulative in-lieu recharge of approximately 300,000 AF of water between 2001 and 2008 (when the Basin Management Plan was published).

Agricultural water use can be grouped into three settings: areas served by organized water suppliers relying on surface water supplies (MID and Stevinson Water District), areas served by other organized agricultural water suppliers, and areas without service from an organized agricultural water supplier. In areas served by organized water suppliers relying on surface water supplies, it is important to prepare for drought by maximizing water use efficiency. Efficient use of water ensures that available surface water supplies can provide the most benefit. However, increased efficiency does require tradeoffs – primarily reduced recharge in wet years. Impacts on recharge must be recognized and actions taken to offset the reduced recharge. In other words, projects that reduce recharge in wet years should include a managed recharge component to increase recharge concurrently through other means. A managed recharge component could include direct recharge of groundwater within the surface water supplier's service area (or other designated areas within the Region), in-lieu recharge through surplus water sales to areas within the Region with inadequate surface water supplies, or a combination of strategies. Areas with inadequate surface water supplies should maximize conservation (to the extent that it remains cost-effective). Most groundwater pumping that exceeds crop requirements ultimately returns to the groundwater basin through deep percolation; therefore, the main benefit of maximizing water conservation is energy conservation.

2.3.7 Stormwater and Flood Management

Stormwater and flood management efforts in the Region are described in the following sections.

Stormwater Management

The County of Merced is the lead agency providing stormwater management within the unincorporated areas of the Region. In addition to the County, various subdivisions within the MID service area use MID canals to discharge stormwater. In general, developers are required to provide storm drainage systems on-site at developments within the unincorporated County. In the cities of Atwater, Livingston, and Merced, stormwater management is the responsibility of the individual jurisdiction.

In 1994, MID created the Merced Irrigation District Drainage Improvement District No. 1. This assessment district regulates and processes agreements, mandates detention and discharge system requirements, and maintains MID facilities for the purpose of receiving urban stormwater from lands within the cities of Merced, Atwater, and Livingston, and unincorporated areas of Merced County. The Improvement District only assesses parcels that drain to MID manmade facilities.

In 2007, the cities of Atwater and Merced, the County of Merced, and MID, collectively referred to as the Merced Storm Water Group, completed a comprehensive Storm Water Management Program (SWMP). The purpose of the SWMP was to limit, to the maximum extent practicable, the discharge of pollutants from the Merced Storm Water Group agencies. The SWMP identifies structural and non-structural BMPs that can be implemented to treat and reduce stormwater pollution (Stantec, 2007).

Concurrent with the 2018 MIRWMP Update, a Stormwater Resources Plan (SWRP) for the Merced Region has been developed. This document complies with the SWRCB Storm Water Resource Plan Guidelines, published by SWRCB in 2015. Similar to the IRWMP, the SWRP includes background information on stormwater management in the Region and includes a list of stormwater projects (solicited concurrently with those for this plan) that would provide multiple benefits to the Region. The SWRP encourages regional solutions to stormwater management issues such as surface water quality, groundwater contamination, and flood management and integrates projects and management activities with the IRWM program.

Flood Management

Flooding in the Region is typically caused by infrequent, severe winter storms, combined with snowmelt runoff from the foothills east of Merced County. Runoff from these storm events traverses the Region via numerous creeks and rivers, ultimately draining to the San Joaquin River. The relatively flat topography of the Planning Area causes floodwaters exceeding the banks of these rivers and streams to spread out over large areas. Figure 2-3 in Section 2.3.2 illustrates the many streams which traverse the Region.

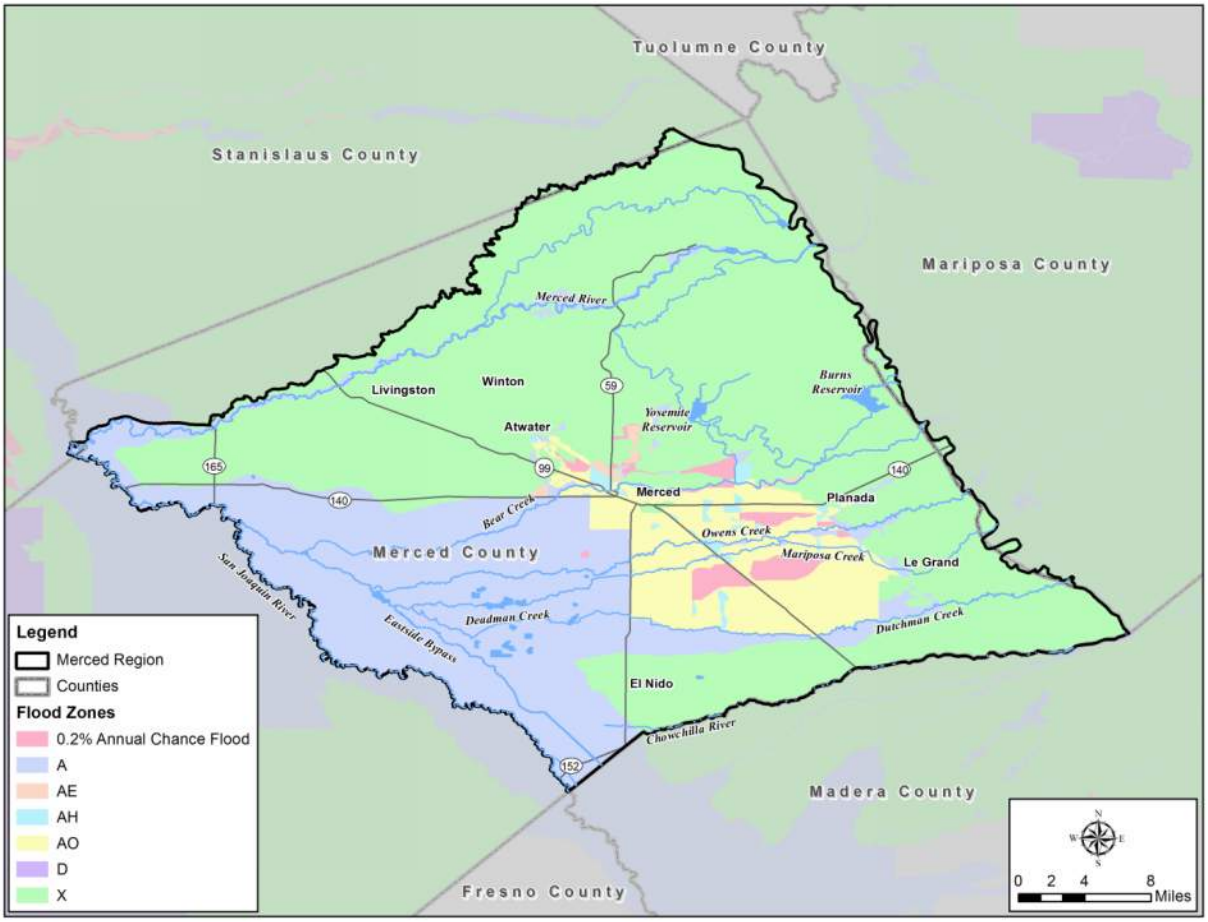
The Merced Region has a long history of active stormwater and flood management, dating back to development of the original Merced County Streams Group project under authorization of the Flood Control Act of 1944 as part of the comprehensive plan for flood control for the Sacramento and San Joaquin River Basins. The Merced County Streams Group project focuses on a collection of streams within the County, including: Black Rascal Creek, Canal Creek, Bear Creek, Burns Creek, Edendale Creek, Fahrens Creek, Miles Creek, Owens Creek, and Mariposa Creek. The creeks comprising the Merced County Streams Group meander through the City of Merced as well as the unincorporated areas of Le Grand, Planada, and the Franklin/Beachwood area, in which flooding is a recurring problem. Numerous projects have been undertaken to address the problem of flooding from the Merced County Streams Group. In 2016, the Merced Streams Group was awarded a grant through the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for the Black Rascal Creek Flood Control Project, intended to alleviate flooding in the Franklin/Beachwood area. This project also previously received Prop 84 funding for design and California Environmental Quality Act (CEQA) work through the IRWM program.

Flooding from the creeks in the Merced County Streams Group is a recurring problem. 2006 flooding is shown below.

While regional flood management efforts have focused primarily on the Merced County Streams Group, generalized flooding occurs throughout the Region. Figure 2-5 presents an overview of areas with potential flood concerns according to mapping from the Federal Emergency Management Agency (FEMA). In general, flood hazard zones are those subject to inundation by a one percent annual chance flood event (100-year flood) or a 0.2 percent annual chance flood event (500-year flood). As shown on Figure 2-5, several areas within the Region are classified within the FEMA-designated 100-year (Flood Zones A, AE, AH, and AO) or 500-year flood zones (0.2 Percent Annual Chance Flood Hazard), and these areas are directly related to creeks within the Merced County Streams Group, such as Owens Creek and Bear Creek.

- Flood Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event (100-year flood zone) but not determined by detailed methods. Mandatory flood insurance purchase requirements and floodplain management standards apply.
- Flood Zone AE: Areas subject to inundation by the 1-percent-annual-chance flood event (100-year flood zone) determined by detailed methods. Mandatory flood insurance purchase requirements and floodplain management standards apply.
- Flood Zone AH: Areas subject to inundation by 1-percent-annual-chance (100-year flood zone) from shallow flooding (usually areas of ponding) where average depths are between one and three feet (not determined by detailed methods). Mandatory flood insurance purchase requirements and floodplain management standards apply.
- Flood Zone AO: Areas subject to inundation by 1-percent-annual-chance (100-year flood) from shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet (determined by detailed methods). Mandatory flood insurance purchase requirements and floodplain management standards apply.
- Flood Zone D: Areas with possible but undetermined flood hazards.
- Flood Zone X: Areas of minimal flood hazard.
- 0.2 Percent Annual Chance Flood Hazard: Areas subject to inundation by 0.2-percent annual chance (500-year flood).

Figure 2-5: FEMA Designated Flood Zones within the Region

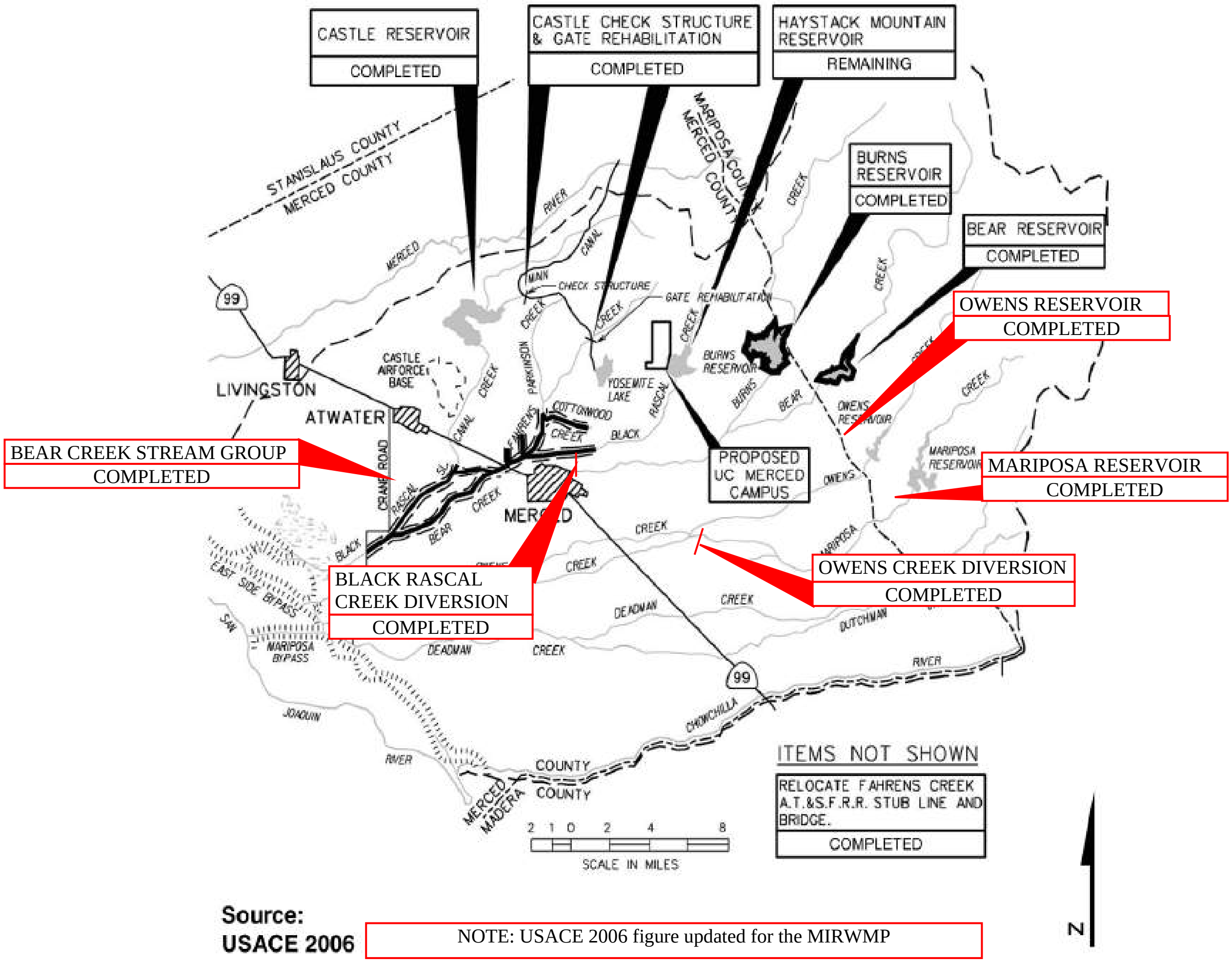


According to FEMA, approximately 380,000 acres in Merced County are located within a 100-year (1% annual chance exceedance) floodplain. A significant component of flooding in urban areas appears to be caused by flow over the southern and/or northern banks of Bear Creek, around the confluence of Black Rascal Creek with Bear Creek. In the unincorporated areas, Miles Creek can overflow its banks to flood portions of Planada, which is exacerbated when Bear Creek overflows into Miles Creek. Mariposa Creek overflow impacts the community of Le Grand.

Flood legislation passed in 2007 established a 200-year (0.5% annual chance exceedance) level of flood protection as the standard for urban development. This means that development in a moderate-flood (FEMA Zone B and the 0.2 Percent Annual Chance Flood Hazard) or high-flood hazard zone (FEMA Zones A, AE, A1-30, AH, AO, AR and A99) would only be allowed if the permitting agency found, based on substantial evidence in the record, that urban or urbanizing areas would be protected to a 200-year-flood level. This applies to all developed areas with population of at least 10,000 (or with plans to reach 10,000 within 10 years).

As previously noted, flood control projects in the Planning Area date back to 1944 with the Merced County Streams Group project. Figure 2-6 summarizes the U. S. Army Corps of Engineers (USACE) progress implementing the Merced County Streams Group project. Note that Marguerite Reservoir/Dam was removed from the project prior to being implemented. The one remaining component that has not yet been completed is a detention basin on Black Rascal Creek. The project was awarded grant funding for design and CEQA work through the IRWM program. In 2016, the project was awarded grant funding from NRCS and construction is expected to begin in 2021 and last through 2022. In addition to the reservoir projects shown in Figure 2-6, improvements along Black Rascal Creek, Bear Creek, Burns Creek, Miles Creek, Owens Creek, and Mariposa Creek were completed. Although channels were improved, very few levees were constructed, and the incised channels are subject to periodic overflows, causing widespread but relatively shallow flooding. Merced County is responsible for maintenance of channels and levees on Black Rascal Creek, Black Rascal Creek Diversion, Burns Creek, Mariposa Creek, Miles Creek, sections of Owens Creek, Owens Creek Diversion, sections of Bear Creek, and Canal Creek. MID performs maintenance of Castle Dam.

Figure 2-6: Merced County Streams Group Project Status



Source:
USACE 2006

The Merced County Streams Group project is only one of several flood control projects in the Planning Area. Figure 2-7 illustrates USACE project levees in the Planning Area, and Figure 2-8 outlines State Plan of Flood Control (SPFC) levees in the Planning Area.

Figure 2-7: USACE Project Levees

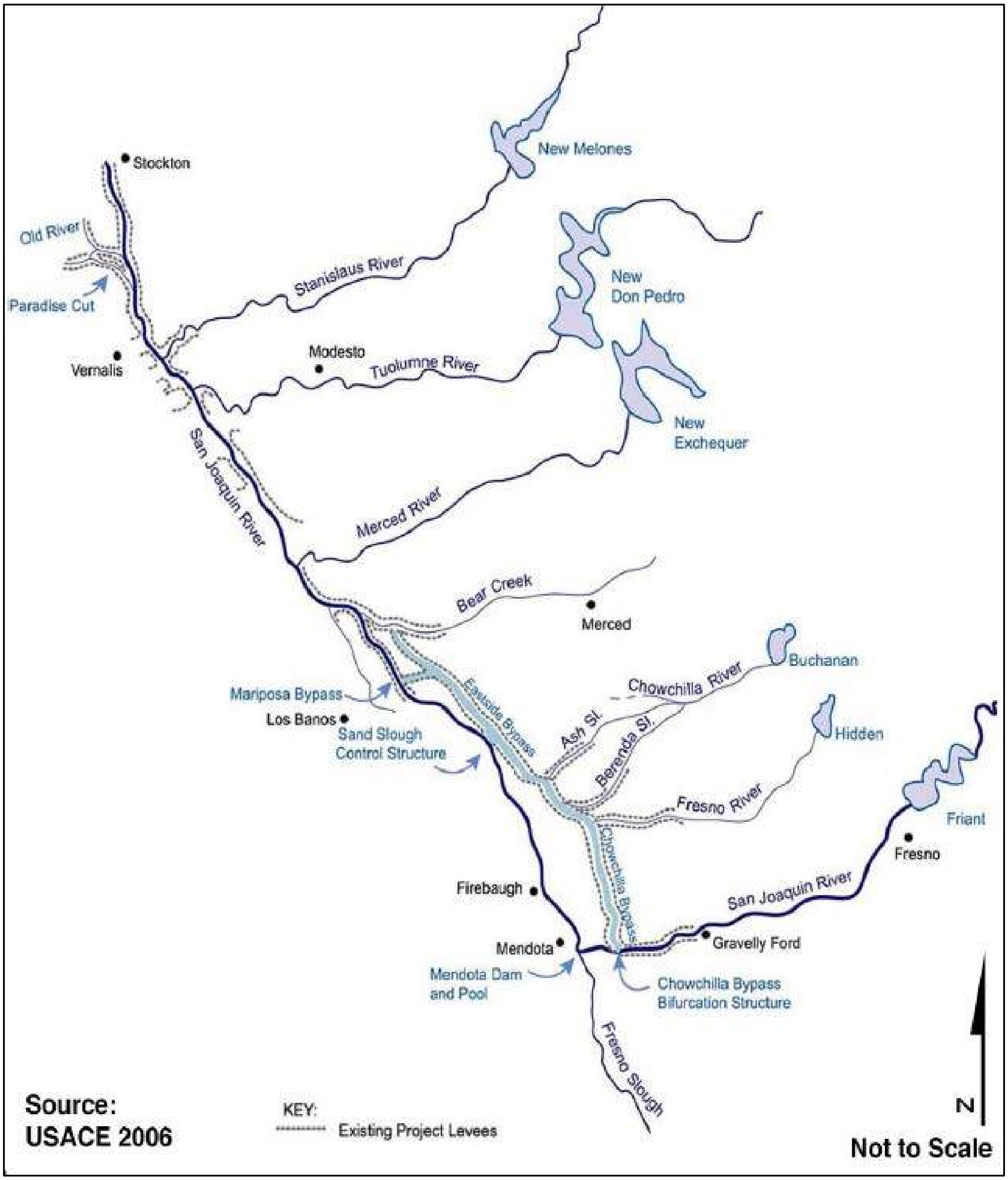
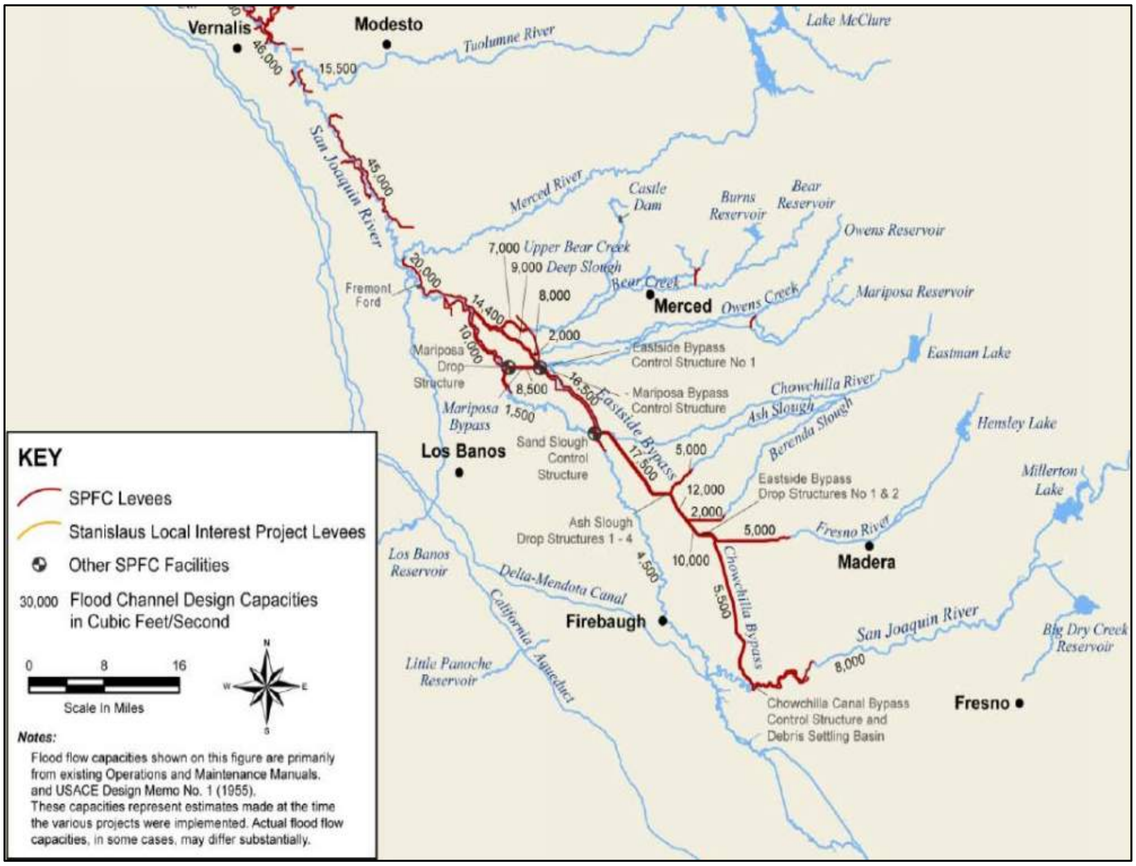


Figure 2-8: State Plan of Flood Control Levees



Source: DWR, 2010c.

2.3.8 Water Conveyance and Storage Infrastructure

In addition to the flood control reservoirs identified in Figure 2-6, the Region is served by a number of surface water storage reservoirs, both within and upstream of the Region.

Surface water storage reservoirs outside the Region include two facilities along the Merced River just northeast of the Region – New Exchequer Dam, which forms Lake McClure (1,024,000 AF) and McSwain Dam, which forms McSwain Reservoir (9,000 AF). About 83 percent of the Merced River watershed lies upstream of the Region. To capture and regulate flows from the Merced River, which is the main source of the surface water used in the Region, MID utilizes Lake McClure as its principal storage and regulating facility. McSwain Reservoir also serves as a regulating facility and as an afterbay, optimizing hydroelectric power generation at New Exchequer.

New Exchequer Dam

Within the Region, MID operates several dams. These include the Pacific Gas & Electric (PG&E) Merced Falls Dam (including the associated hydroelectric facility) and the Crocker-Huffman Dam, which MID uses to divert water from the Merced River into MID's primary water conveyance canals and off-stream storage at Lake Yosemite and Castle Dam. MID also operates a number of diversion dams on Bear Creek, Miles Creek, Owens Creek, Mariposa Creek, and Deadman Creek to divert water for various beneficial uses including recharge, depending on the respective rights. In addition, MID operates and maintains a number of regulating basins within its distribution area. Buchanan Dam, which impounds Eastman Lake (150,000 AF), provides surface water to areas of CWD within the Region.

Crocker-Huffman Dam

2.4 Natural Communities and Habitats

The Region contains a vast amount of open space and agricultural lands which provide unique natural communities and habitats, such as pristine vernal pool grasslands, highly specialized unique plant and animal species, large managed wetland preserves, and wildlife-based recreational opportunities (Merced County, 2007).

The East Merced Resource Conservation District (EMRCD) works to develop ongoing programs to conserve natural resources in eastern Merced County (east of the San Joaquin River). EMRCD has identified three primary geographic land use regions within its jurisdiction, which nearly covers the Region in its entirety. These geographic land uses, which play a role in the overall health and functioning of the watersheds within the Region, are crop and dairy lands, rangelands and vernal pools, and the Lower Merced River Corridor. Figure 2-9 provides an overview of land uses within the Region, including habitat areas.

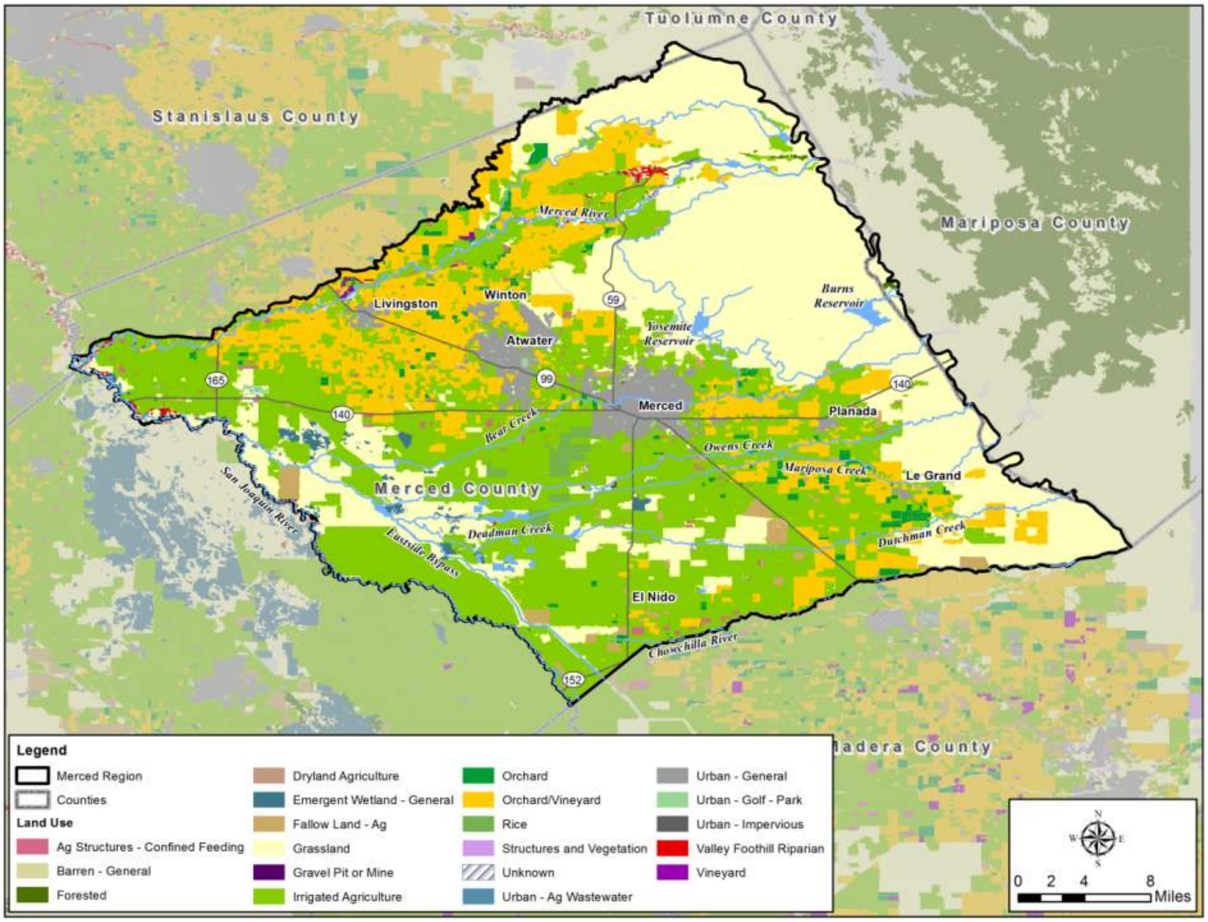
The Cities of Merced and Atwater both have conjunctive reuse programs that provide water treated from local wastewater facilities for use on crop and dairy lands and designated wetland areas. Environmental water demands are growing within the Region as the Region enjoys vast tracks of wildlife refuges, conservation easements and duck clubs, especially along the San Joaquin River corridor.

MID provides 15,000 AFY to the Merced National Wildlife Refuge to sustain local habitats and provides water transfers to local refuges such as the East Bear Creek Unit of the San Luis Wildlife Refuge when surface water is available. MID has been actively involved with various fisheries agencies in providing pulse flows with designed time, peak and duration for the purpose of attracting adult Chinook salmon since 1999. The MID has entered into different agreements and transfers for providing spring pulse flows with the most recent in 2013.

MID coordinates with various fisheries agencies including the Department of Fish and Wildlife and its Merced River Fish Hatchery.

In July 2018, the SWRCB released its final *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 40 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 the Merced River, restricting MID's ability to divert surface water and conjunctively manage the Merced Subbasin. Additionally, the proposed action has the potential to negatively impact fall-run Chinook as the changes may lead to increased temperatures of releases from reservoirs.

Figure 2-9: Regional Habitat Map

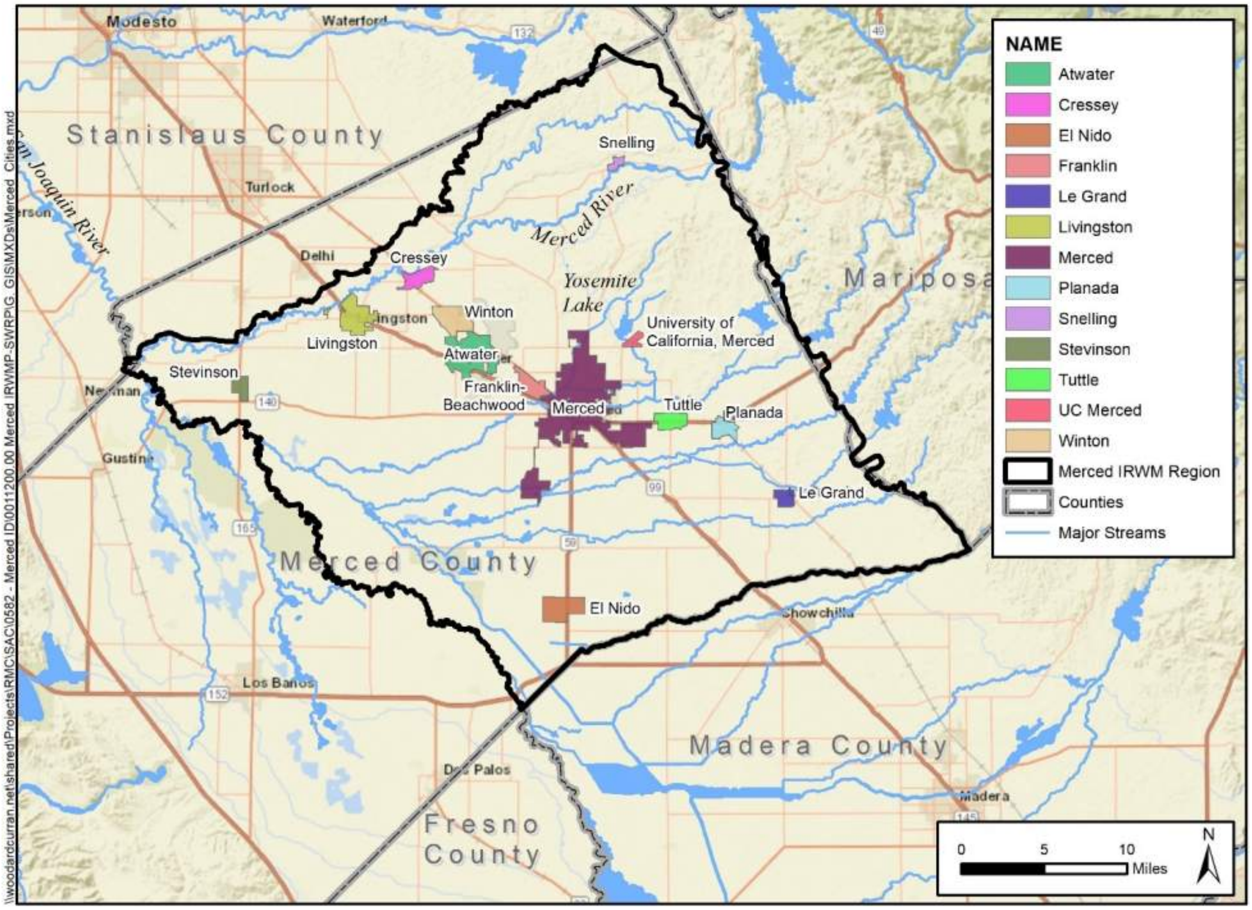


2.5 Internal Boundaries

There are five entities within the Region with land use jurisdiction: the County of Merced, the City of Merced, the City of Livingston, the City of Atwater, and the UC Merced. The cities of Merced, Atwater, and Livingston and UC Merced are contained entirely within the Region, while only a portion of Merced County lies within the Region.

The Region encompasses the following unincorporated communities within eastern Merced County: Celeste, Cressey, El Nido, Franklin/Beachwood, Le Grand, Planada, Snelling, Stevinson, Tuttle, and Winton. Figure 2-10 shows the incorporated cities and unincorporated communities within the Region.

Figure 2-10: Merced Region Cities and Communities



2.6 Water Supplies and Demand

Water supply and demand within the Region are described in the following sections.

2.6.1 Water Supply

Water supply within the Region is primarily groundwater pumped from the Merced Subbasin and surface water sources from the Merced, Chowchilla, Tuolumne and San Joaquin Rivers and smaller creeks and streams. Groundwater is also withdrawn from the Turlock and Chowchilla Subbasins by private users within the Merced Region (in addition to suppliers outside the Merced Region who overlie those basins).

Merced Subbasin

The Merced Region primarily overlies the Merced Subbasin. Groundwater management, historic trends and conditions, and existing and projected groundwater supplies in the Merced Subbasin are described in the following sections. Water suppliers in the Merced Region do not draw on the Turlock or Chowchilla Subbasins (with the exception of Eastside Water District, whose members obtain water from the Turlock Subbasin); private well owners pump from all basins in the Region. Because the Merced Subbasin is the source of groundwater for nearly all groundwater suppliers in the Region, discussion of groundwater management focuses only on this subbasin.

Groundwater Management

The Merced Groundwater Subbasin is one of 21 basins in California identified by DWR as critically overdrafted, and one of 48 basins considered high priority. Consistent with the requirements of SGMA, water management and land management agencies in Merced Subbasin have formed three Groundwater Sustainability Agencies (GSAs): the Merced Irrigation-Urban GSA, the Merced Subbasin GSA, and the Turner Island Water District GSA. The three GSAs are collaborating on developing one Groundwater Sustainability Plan (GSP) for the entire Merced Groundwater Subbasin by January 2020. To develop the GSP, the GSAs will review groundwater conditions and identify means to ensure the long-term sustainability of the Merced Groundwater Subbasin. The Turlock and Chowchilla Subbasins are also designated as high-priority, and the Chowchilla Subbasin is also designated as being in a state of critical overdraft. Critically-overdrafted basins are required to comply with SGMA on an accelerated timeline and must be managed under a GSP beginning February 1, 2020. Other high- and medium-priority subbasins (including the Turlock Subbasin) must be managed under a GSP beginning February 1, 2022. GSPs are prepared by one or more Groundwater Sustainability Agencies (GSAs). The Chowchilla Subbasin will be covered by a GSP prepared by the Chowchilla Water District GSA, the County of Madera GSA, Triangle T Water District GSA, and the County of Merced Chowchilla Subbasin GSA, while the Turlock Subbasin will be covered by a GSP prepared by the East Turlock Subbasin GSA and the West Turlock Subbasin GSA.

Groundwater Levels and Historical Trends

According to the 2008 Groundwater Management Plan Update, Merced Subbasin groundwater elevations have been monitored by DWR, MID, and other entities since the 1950's. These monitoring data demonstrate that, since 1980, average groundwater levels within the Merced Subbasin have declined approximately 14 feet, with most of this decline occurring between 1980 and 1996. As such, the Merced Subbasin is considered to be in a state of mild long-term groundwater level decline. However, a notable exception to this trend is the El Nido area, where the rate of groundwater level decline has shown a substantial decrease since 1980 due to increased delivery of surface water to the area by MID. Decline in groundwater is normalized over the entire base; however, local decreases ranged from 5 feet in the southwesterly area to more than 50 feet south of Le Grand, along the Chowchilla River. The prolonged drought between 2012 and 2015 caused significant decline in groundwater levels within the subbasin (MID, 2016).

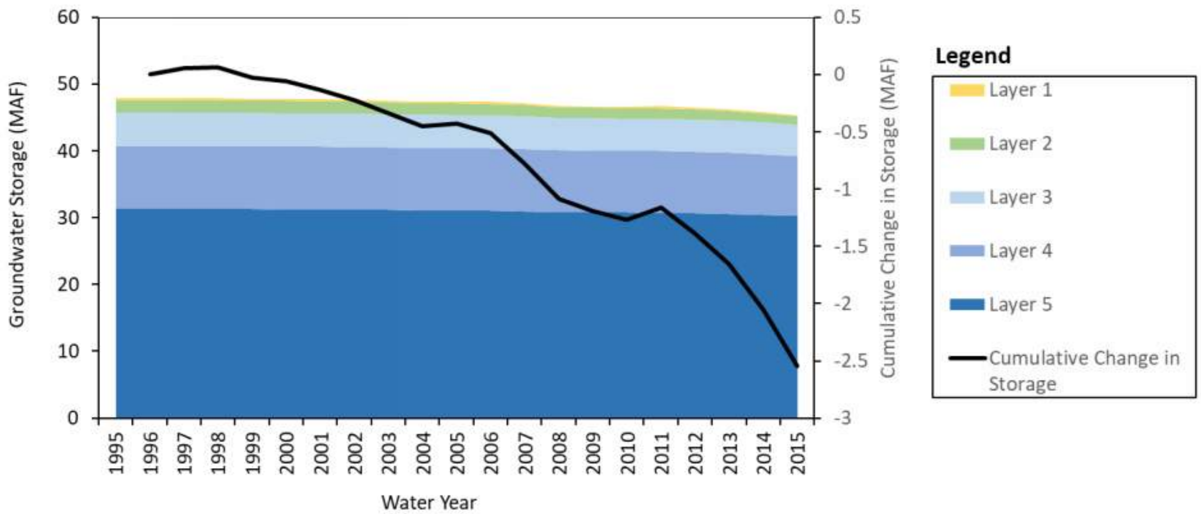
Groundwater used within the Region is primarily pumped from the Merced Subbasin. This photo shows a typical MID groundwater well.

Existing and Projected Groundwater Supplies

The draft Merced Subbasin GSP makes use of the Merced Water Resources Model (MercedWRM), a fully integrated surface and groundwater flow model covering approximately 1,500 square miles of the Merced Groundwater Region. The MercedWRM, was developed using the Integrated Water Flow Model (IWFM) 2015 software package to simulate the relevant hydrologic processes prevailing in the Region. The Model integrates the groundwater aquifer with the surface hydrologic system and land surface processes and operations. Using data from federal, State, and local resources, the MercedWRM was calibrated for the hydrologic period of October 1995 to September 2015 by comparing simulated evapotranspiration, groundwater levels, and streamflow records with historical observed records. Development of the model involved the study and analysis of hydrogeologic conditions, agricultural and urban water demands, agricultural and urban water supplies, and an evaluation of regional water quality conditions (RMC Water and Environment, 2017).

The model uses five distinct fresh-water aquifer layers, one saline aquifer, and two confining units. The MercedWRM was used to model current and historical change in storage of the Merced Subbasin from 1995-2015. As of 2015, the Subbasin had an estimated fresh groundwater storage volume of approximately 45.3 MAF (million acre-feet). Figure 2-11 shows annual total storage for each MercedWRM freshwater layer as well as the cumulative change in storage of -2.55 MAF from 1995-2015.

Figure 2-11: Historical Modeled Change in Storage by MercedWRM Layer (million acre-feet)



The most urgent groundwater management issues in the Subbasin are related to overdraft and ensuring safe, reliable drinking water to DACs. Over 90% of the geographic area of the Region is considered a DAC. Within the area overlying the Merced Subbasin, roughly 80% of the population lives in communities considered disadvantaged. Of the DACs in the Subbasin, half of them meet the more stringent criteria to be considered severely disadvantaged communities (SDACs). These communities rely entirely on groundwater for their water supply.

According to the 2008 Groundwater Management Plan Update, groundwater levels within the Merced Subbasin declined by an average of approximately 3.7 feet per year between 1995 to 2007. Using an assumption of a 9.0 percent average specific yield, this decline in groundwater levels represents a decrease in storage capacity of approximately 117,200 AF. Historical data suggests that the Merced Subbasin experiences periods of long-term groundwater level decline and subsequent recovery, with a general trend toward mild groundwater level decline and a cumulative decrease in storage of approximately 720,000 AF from 1980 to 2007. Although there have been attempts to estimate safe yield in the basin, a defensible and robust safe yield estimate will require a comprehensive hydrologic and groundwater study. GSAs are currently in the process of preparing GSPs, which will include estimates of the safe yield of each Subbasin in the Region. These estimates will guide the long-term management of the groundwater basin and the water supplies in the Region.

Groundwater supply is difficult to estimate for the Region as groundwater supplies depend upon numerous varying factors. Groundwater is frequently used by private pumpers to meet demands not met by surface water supplies. As such, groundwater pumping generally increases in drought years when there is not enough surface water available to meet water demands. According to the Merced Groundwater Management Plan Update, all municipal water purveyors within the Merced Subbasin rely solely on groundwater for water supply (AMEC Geomatrix, Inc., 2008). The most recent available data on groundwater usage by municipal suppliers are summarized in Table 2-3. Agricultural demand is met with a combination of surface water and groundwater, with roughly 595,000 AFY of groundwater being used for agriculture (AMEC Geomatrix, Inc, 2008). MID provides roughly 275,000 AFY of surface water to meet additional agricultural demand (AMEC Geomatrix, Inc, 2008).

The Merced Region is committed to stabilizing groundwater elevations in the Merced Subbasin, with prior work on this effort including preparation of the *Merced Water Supply Plan Update – Final Status Report* (CH2M Hill, 2001), and convening Merced Water Supply Task Force, a joint effort between MID and City of Merced. Most recently, under SGMA, subbasin GSAs will prepare and implement GSPs. These GSPs will identify management actions, projects, and demand reductions, along with an implementation schedule and monitoring, to put each subbasin on a path to sustainable groundwater use by 2040.

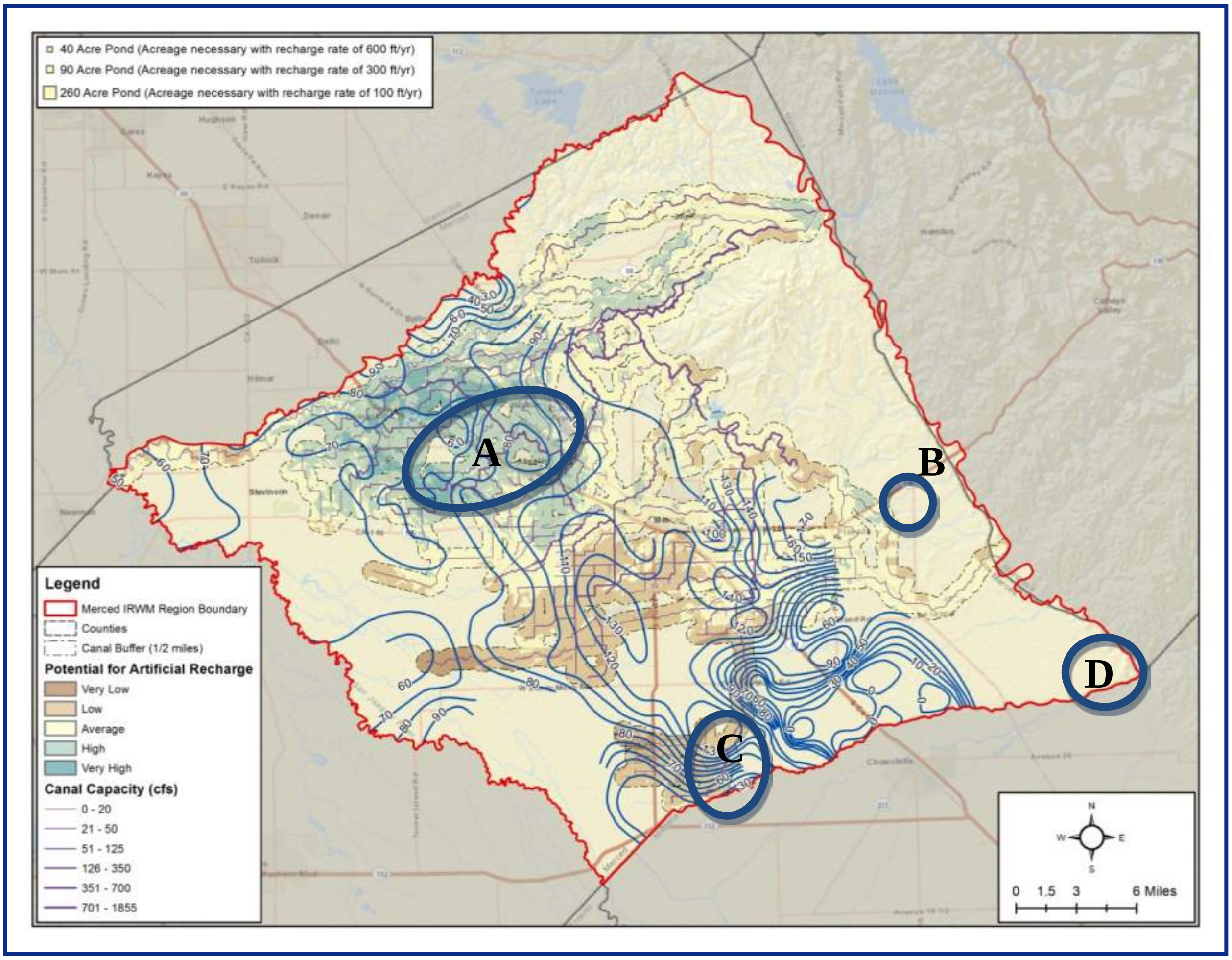
Groundwater Recharge

As part of the 2013 IRWM planning effort, the Region completed a *Groundwater Recharge Feasibility Study* (RMC, 2013a). The purpose of this study was to define areas with high potential for recharge. An understanding of areas with high potential for recharge and factors that influence recharge assists in identifying where recharge projects should be considered, where recharge is occurring currently and where existing land use has impacted recharge. Identification of recharge areas and mechanisms can also assist in preserving and managing important natural features such as riparian areas or stream channels. Anthropogenic recharge, particularly deep percolation from agricultural irrigation and earthen-lined canals, is a key source of recharge in the Merced Region. Identifying where this and other human-influenced recharge is occurring provides an assessment of current recharge and assists in the recognition of the effects of land use change. Four opportunity areas were identified through the Recharge Feasibility Study, as shown in Figure 2-12. Opportunity Area A is located south and east of Livingston; Opportunity Area B is located north of Planada; Opportunity Area C is located near El Nido; and Opportunity Area D is located in the eastern corner of the Merced Region.

Within Opportunity Area B, a project was formulated and received grant funding as part of the SGMA Prop 1 funding process. The proposed Planada Recharge Basin Pilot Project will benefit the community of Planada (a SDAC) by identifying a viable site to recharge groundwater in a high-priority, critically-overdrafted basin. Limited recharge sites exist within and around Planada because of the geology of the area, in particular the prevalence of overlying clay areas. The goal of this project is to develop a pilot recharge basin near Planada and evaluate whether groundwater recharge using surface water supplies can improve local groundwater levels for this SDAC. Objectives of this project are:

- Evaluate two potential groundwater recharge sites in the vicinity of the Planada SDAC; and
- Construct and successfully operate a three-year pilot groundwater recharge basin.

Figure 2-12: Groundwater Recharge Opportunity Areas



Surface Water

Surface water is primarily supplied to the Region from the Merced River. Merced River supplies originate from diversions into the MID distribution system through the Northside Canal from the Merced Falls Dam, and through the Main Canal from the Crocker-Huffman Diversion Dam. From 2003-2015, MID diversions from the Merced River averaged 430,000 AF/yr (MID, 2016). Portions of this Merced River diversion are delivered to Stevinson Water District and Merquin County Water District.

Surface water is primarily supplied to the Region from diversions along the Merced Region. This photo shows MID's Main Canal Diversion.

Other surface water sources include the Chowchilla and San Joaquin Rivers and permanent and ephemeral streams such as Bear Creek, Black Rascal Creek, Burns Creek, Canal Creek, Cottonwood Creek, Deadman Creek, Fahrens Creek, Little Dutchman Creek, Mariposa Creek, and Owens Creek. Gauging stations located on Burns Creek, Bear Creek, Mariposa Creek, and Owens Creek indicate that between 1993 and 2013, annual outflow from the Region's creeks ranged from 15,000 AFY to 238,700 AFY, with an average of approximately 94,000 AF (AMEC Geomatrix, Inc., 2008). DWR estimates that approximately half of the inflow from surface water bodies (approximately 47,000 AFY) infiltrates and recharges the Merced Subbasin (AMEC Geomatrix, Inc., 2008).

Water Supply Projections

Water supply projections for the Region are presented in Table 2-3. These projections are based on supply projections from each urban water supplier's most recent UWMP or AWMP and best available data for other municipal and agricultural water suppliers. Many private wells exist within the Region, including in areas covered by other water suppliers. Private groundwater pumping is an important water source in the Region and is not included in Table 2-3 due to lack of data. Development of the Merced Subbasin GSP will result in greater data availability in the future.

Table 2-3: Anticipated Water Supply through 2040

	2015 (AFY)	2020 (AFY)	2025 (AFY)	2030 (AFY)	2035 (AFY)	2040 (AFY)
Municipal						
City of Atwater[1]	14,737	17,084	19,805	19,805	19,805	19,805
City of Livingston[2]	2,191	2,257	2,330	2,413	2,503	2,604
City of Merced[3]	22,741	31,260	33,287	35,875	37,829	37,829
Le Grand CSD[4]	2,016	2,016	2,016	2,016	2,016	2,016
Planada CSD[4]	4,817	4,817	4,817	4,817	4,817	4,817
Winton Water and Sanitary District[4]	6,777	6,777	6,777	6,777	6,777	6,777
Meadowbrook District, California American Water Company[5]	1,220	1,220	1,220	1,220	1,220	1,220
Agricultural						
MID – Groundwater[6]	36,858	2,000	1,000	0	0	0
MID – Surface Water[7]	516,110	516,110	516,110	516,110	516,110	516,110
Le Grand/Athlone Water District[5]	372	372	372	372	372	372
Merquin County Water District[5]	14,281	14,281	14,281	14,281	14,281	14,281
Stevinson Water District[8]	44,750	44,750	44,750	44,750	44,750	44,750
Turner Island Water District[9]	25,000	25,000	25,000	25,000	25,000	25,000
Chowchilla Water District[10]	43,000	43,000	43,000	43,000	43,000	43,000

Notes:

1. Water supply projections from City of Atwater 2005 UWMP are available through 2025 (Boyle Engineering Corporation, 2007). Water supplies after 2025 are assumed to be equivalent to 2025 conditions.
2. Water supply projections from City of Livingston 2015 UWMP are available through 2040 (AM Consulting Engineers, 2016).
3. Water supply projections from City of Merced 2015 UWMP are available through 2035 (Carollo, 2017). Water supplies after 2035 are assumed to be equivalent to 2035 conditions.
4. Water supply projections for Winton Water and Sanitary District, Le Grand CSD, and Planada CSD assume the current capacity of groundwater supply infrastructure remains constant through 2040.
5. Water supply projections for Meadowbrook District California American Water Company, Le Grand/Athlone Water District, and Merquin County Water District assume the supply is equal to estimates of demand provided during preparation of the 2013 IRWMP.
6. MID groundwater supply projections (2020-2040) were provided by MID staff. 2015 groundwater pumping is available from the 2015 MID AWMP (MID, 2016). MID owns 242 groundwater supply wells, of which, 170 are currently operational. MID groundwater pumping increases during drought years as part of its conjunctive management. In addition, MID constituents utilize their personal groundwater wells either for supply or to supplement surface water supply. For example, in 2015 MID extracted roughly 36,858 AF and private agricultural users within its boundary extracted approximately 355,000 AF (MID, 2016).
7. MID surface water supply projects assume MID's water rights remain constant. According to the MID Water Management Plan (MID, 2003), MID has water rights that allow withdrawal and storage of up to 516,110 AF of surface water from the Merced River per year. As discussed in Section 2.4, SWRCB is proposing to reduce diversions from Merced River, which would curtail the use of the Merced River as a supply source for the Region; however at this time the outcome is unknown.
8. Water supply projections based on communication with Stevinson Water District. The listed supply projection is an average of the above normal year prediction (45,750 AF) and the below normal year prediction (43,750). No projections for a normal year were provided. A constant supply was assumed.
9. Supply for Turner Island Water District is assumed to be equal to the delivery amount provided by Turner Island Water District staff and is assumed to be constant through 2040.
10. Chowchilla Water District water supply projections assume the District maintains delivery of 43,000 AFY from Buchanan Dam. Chowchilla Water District also receives water from the Madera Canal; supply from Madera Canal is not included in these projections.

2.6.2 Water Demand

Water demand within the Region is both spatially and temporally variable, depending upon land use, population, and agricultural specifics such as the types of crops grown. Water demand projections for the Region are presented in Table 2-4. The projections for urban demands are based on projections from each urban water supplier's most recent UWMP and demands for the unincorporated areas are based on estimates developed for the Merced County General Plan Update (Merced County, 2013).

Table 2-4: Anticipated Water Demand through 2040

	2015 (AFY)	2020 (AFY)	2025 (AFY)	2030 (AFY)	2035 (AFY)	2040 (AFY)
Municipal						
City of Atwater[1]	14,737	17,084	19,805	22,975	26,650	30,855
City of Livingston[2]	2,190	2,257	2,330	2,413	2,503	2,604
City of Merced[3]	22,741	31,260	33,287	35,875	37,829	37,829
Unincorporated Urban Areas[4]	ND	ND	8,050	8,050	8,050	8,050
Agricultural						
MID[5]	305,000	305,000	305,000	305,000	305,000	305,000
Le Grand/Athlone Water District[6]	372	372	372	372	372	372
Merquin County Water District[7]	14,281	14,281	14,281	14,281	14,281	14,281
Stevinson Water District[8]	34,750	34,750	34,750	34,750	34,750	34,750
Turner Island Water District[9]	25,000	25,000	25,000	25,000	25,000	25,000
Chowchilla Water District	ND	ND	ND	ND	ND	ND

Notes:
ND = No Data
1. Water demand projections from City of Atwater 2005 UWMP are available through 2025 (Boyle Engineering Corporation, 2007). Water demands after 2025 are calculated assuming the growth rate between 2020 and 2025 remains constant in the future.
2. Water demand projections from City of Livingston 2015 UWMP are available through 2040 (AM Consulting Engineers, 2016). Note that recycled water demands are not included in the projection.
3. Water demand projections from City of Merced 2015 UWMP are available through 2035 (Carollo, 2017). Water demand for 2040 is assumed to be equal to the demand projected for 2035.
4. Unincorporated urban demands are based on the *Qualitative Comparison of Water Supply and Demands in Merced County Technical Memorandum* prepared for the Merced County General Plan Update, which provides estimates of urban demands at buildout. Buildout conditions are assumed to occur in 2025 (Nolte Associates, 2009).
5. Water demand projections are dependent on many pending factors, including final FERC relicensing, conversion from agricultural to urban areas, and future cropping and irrigation practices. Demand will also be impacted by activities related to SGMA such as more water demand in flood events. At this time and until better information is available existing demands are shown based on MID Water Management Plan (MID, 2003).
6. Water demand projections assume the existing demands remain constant through 2040. Existing demands are based on MID Water Management Plan (MID, 2003).
7. Water demand projections assume the existing demands for Merquin County Water District remain constant through 2040. Existing demands are based on the *Qualitative Comparison of Water Supply and Demands in Merced County Technical Memorandum* prepared for the Merced County General Plan Update (Nolte Associates, 2009).
8. Demands through 2040 were calculated based on crop type, acreage, and water use provided by Stevinson Water District (R. Kelley, personal communication, August 17, 2018). Projections assume that Stevinson Water District demands remain constant. Transfers, system losses, and wetland habitat demands are not included in these estimates.
9. Demands are based upon delivery information provided by Turner Island Water District. Demands are assumed to remain constant through 2040.

Groundwater demands (groundwater use) are difficult to measure within the Region because there are numerous unmetered private groundwater wells. Modeling efforts indicate that groundwater demands are highest during dry years. Conversely, modeling data indicate that, during wet years when surface water is abundant, groundwater pumping is significantly reduced. These modeling data reinforce the trend noted previously, in which groundwater levels stabilize or recover to a higher elevation during multiple wet years. An integrated groundwater and surface water model is under development which will help to better characterize the Region's water demands.

The Merced Subbasin is not regulated through a JPA or adjudication; therefore, there are no defined legal pumping rights or constraints on groundwater pumping for groundwater users in the Region. However, under SGMA, GSAs have authority to establish groundwater extraction allocations. SGMA does not alter water rights, but provides broad authority to implement and enforce allocations to basin users. A major part of the development of the GSP will be establishing the sustainable yield of the basin and developing an allocation framework, along with projects and management actions, to bring the basin into sustainability.

2.7 Water Quality

Water quality objectives for the Region are established within the *Water Quality Control Plan for the San Joaquin River Basin* (Basin Plan) (CVRWQCB, 2016). The Basin Plan is intended to protect surface and groundwater quality throughout the San Joaquin River Basin, which includes the Merced Region. MCLs, established by the U.S. Environmental Protection Agency (USEPA) under the Safe Drinking Water Act, are the standard by which water quality is described throughout this section. MCLs are the maximum allowable concentration of contaminants in surface or groundwater delivered as drinking water following any required treatment.

2.7.1 Groundwater Quality

The entire City of Merced overlies the Merced Subbasin. Groundwater within the Merced Subbasin contains both man-made and naturally occurring constituents. Some of these constituents either currently impact or have the potential to impact groundwater use within the Region in the future. A salinity and nutrient study was completed as part of the 2013 IRWM planning effort to establish the baseline water quality conditions within the Merced Region (RMC, 2013b). Information from the study is summarized in this section.

Salinity

Groundwater salinity results from the presence of various salts, metals, and inorganic compounds dissolved in groundwater. Salts are composed of positively charged cations and negatively charged anions that dissociate when dissolved in water. Common dissolved salts in groundwater include calcium, sodium, potassium, chloride, carbonate, sulfate and perchlorate. Common dissolved metals and nutrients in groundwater include arsenic, iron, hexavalent chromium, manganese, nitrate, potassium, and phosphate.

Historically, groundwater beneath the Merced Region has been categorized as primarily calcium-bicarbonate to sodium-bicarbonate type water due to variability in soil conditions, soil type, geologic structure, irrigation practices, and irrigation water quality, especially in the upper water-bearing zone. Sodium-rich groundwater may require the addition of soil amendments (such as gypsum) in order to percolate through soil, increasing salt loading in the Merced Region. In general, groundwater salinity concentrations are lowest in the easterly portion of the Merced Region, and increases westward toward the San Joaquin River and southward toward the Chowchilla River. A small area of predominantly sodium-chloride type water has been identified near the confluence of the Merced and San Joaquin Rivers.

Salinity, which is generally measured by total dissolved solids (TDS), has a secondary MCL of 1,000 (upper limit) to 1,500 (short-term limit) milligrams per liter (mg/L). TDS in the eastern two-thirds of the Merced Subbasin generally measures less than 500 mg/L. TDS in the northwestern portion of the Region is slightly elevated beneath the Atwater and Winton areas. TDS in groundwater also increases in the western portion of the Region towards the San Joaquin River to as much as 1,000 mg/L. In these areas, high TDS water is found in wells deeper than 350 feet. Better quality groundwater (less than 1,000 mg/L TDS) in these areas is found at shallower depths (RMC, 2013b). According to the 2015 UWMP for the City of Merced, the TDS levels have a typical range of 200-400 mg/L.

In general, groundwater with high concentrations of TDS is present throughout the Merced Subbasin, generally located at depths between 400 to 800 feet. Saline waters originating from ancient marine sediments are migrating upward and mixing with freshwater in the basin. This process results from natural conditions; however, pumping of deep wells within the western and southern parts of the Merced Subbasin may cause these saline waters to upwell and mix with fresh water more rapidly than under natural conditions.

Nitrate

Nitrate originates from both natural and man-made sources and can be found in groundwater in many parts of the San Joaquin Valley. Elevated nitrate concentrations are generally of concern for potable water supplies and are not a concern for many crops because they act as a fertilizer. However, crops such as grape vineyards may be adversely impacted by high nitrate concentrations.

The MCL for nitrate is 45 mg/L as NO_3 for public drinking water supplies, and several municipal water districts have reported wells that have reached or are approaching the MCL. High nitrate concentrations in groundwater are often associated with the use of fertilizers (commercial/animal waste) and onsite wastewater treatment systems (OWTS or septic systems). Within the Merced Region, nitrate concentrations range from non-detect (less than 2 mg/L as NO_3) to as high as 330 mg/L as NO_3. The 5-year average (2007 through 2012) nitrate concentration in groundwater in the Merced Region is generally less than 20 mg/L as NO_3. In the northwest quadrant, there is a small area where nitrate concentrations exceed 200 mg/L as NO_3. Several larger areas also exist where nitrate concentrations do not exceed the MCL but range from 20 to 40 mg/L. The elevated nitrate concentration in these areas may be associated with animal confinement facilities and other agricultural non-point sources. Elevated nitrate in groundwater exists in small areas northeast of Merced and southwest of Atwater among areas where high densities of onsite wastewater treatment systems (OWTSs) occur.

Chloride

Chloride is a dissolved salt commonly associated with saline groundwater. Within the Merced Region, Cl concentrations range from non-detect (less than 2 mg/L) to as much as 1,850 mg/L. The recommended secondary MCL for chloride is 250 mg/L and the upper secondary MCL is 500 mg/L (CDPH, 2011). The 5-year average (2007 through 2012) chloride concentration in groundwater in the northern two quadrants of the Merced IRWM Region is generally less than 50 mg/L. Like TDS, chloride in groundwater increases in the southern quadrants towards the San Joaquin River to as much as 500 mg/L.

Iron and Manganese

Iron and manganese are both regulated through secondary MCLs, which are non-enforceable guidelines that regulate contaminants that affect drinking water aesthetics. The secondary MCLs for iron and manganese are 0.3 mg/L and 0.05 mg/L, respectively.

Groundwater in some portions of the Merced Subbasin contains elevated iron and manganese concentrations that exceed the secondary MCLs. Such areas are generally at shallow depths where oxygen levels are low or associated with shallow groundwater areas near streams.

Arsenic

Arsenic, which can have human health impacts, is naturally found within many bedrock formations. The current California MCL for arsenic is 0.010 mg/L. The 5-year average (2007 through 2012) arsenic concentration in groundwater in the northern two quadrants of the Merced Region is generally less than 0.010 mg/L, below the MCL. There are localized areas where the average arsenic concentrations in shallow groundwater range between 0.020 and 0.050 mg/L (e.g., northeast of Atwater, near Stevinson, and in the southwest Merced IRWM area near the intersection of Sandy Mush Road and Highway 59). The City of Livingston also has wells with arsenic levels at or above the MCL. The City has constructed groundwater treatment systems at multiple wells to reduce arsenic concentrations below the MCL (AM Consulting Engineers, 2016).

Hexavalent Chromium

Hexavalent chromium (Cr6) is a dissolved metal that rarely occurs naturally and can be associated with industrial contamination in groundwater. The SWRCB established a Cr6 MCL in 2014, but the MCL was invalidated by a court decision in 2017 and was rescinded. The SWRCB will create a new MCL, likely in 2019 (SWRCB, 2017). While there is currently no primary MCL for Cr6, Cr6 is a component of total chromium and is therefore regulated under the total chromium MCL. The primary MCL for total chromium is 50 micrograms per liter (μg/L) (CDPH, 2011). Within the Merced Region, Cr6 concentrations range from non-detect (less than 0.01 μg/L) to as high as 370 μg/L. The 5-year average (2007 through 2012) Cr6 concentration in groundwater in the Merced Region is generally less than 1 μg/L, except for a small area in the northwest quadrant where concentrations exceed 100 μg/L. This area of elevated Cr6 concentrations is likely associated with point sources.

Radionuclides

Radionuclides, including alpha particles and uranium, have MCLs of 15 picocuries per liter and 30 μg/L, respectively. Data for radionuclides in the Region are not available at this time, and testing for these constituents is generally limited to public water systems.

Bacteria

Levels of bacteria within the Merced Subbasin are generally acceptable for deep groundwater aquifers. Bacteria is of primary concern for drinking water systems, and bacteria is regulated based on the number of service connections within a given drinking water system. DDW requires testing for pathogens (disease-causing organisms) and indicator organisms within drinking water systems. Elevated bacteria in groundwater can occur due to inadequate construction, improperly located, destroyed, and abandoned groundwater wells, and improper use of groundwater wells for waste disposal.

Perchlorate

Perchlorate occurs from both natural and man-made sources and is widespread in groundwater in many parts of the San Joaquin Valley. High perchlorate concentrations in groundwater are often associated with the use of nitrate fertilizer or munitions manufacturing. Within the Merced Region, perchlorate concentrations range from non-detect (less than 2 μg/L) to as high as 4 μg/L. The primary MCL for perchlorate is 6 µg/L (CDPH, 2011). Slightly elevated perchlorate concentrations observed in groundwater beneath the Atwater area may be associated with point sources.

Petroleum Hydrocarbons

Petroleum hydrocarbons, including oxygenates such as methyl-tertiary-butyl-ether (MTBE), have been released from underground storage tanks (USTs). Most of these cases are localized in nature; the SWRCB and CVRWQCB conduct mitigation oversight for soil and groundwater cleanup of UST releases.

The 5-year average (2007 through 2012) MTBE concentration in groundwater in the Merced Region is generally less than 5 µg/L, with elevated concentrations found in localized urban areas along Highway 99 and beneath the Atwater area.

Pesticides

DBCP, a pesticide banned in 1977, continues to be found in groundwater within the Region. The MCL for DBCP is 0.0002 mg/L (0.2 µg/L), as DBCP can potentially be a carcinogen even at very low concentrations. DBCP has been found in public and domestic water supply wells.

In addition, the cleaning and degreasing solvent, TCP, also used as a soil fumigant, has been detected in the Merced Region, with elevated concentrations found in localized areas in the northwest quadrant and beneath the City of Merced. Until an MCL is developed, DDW is utilizing a Notification Level of 0.005 µg/L (CDPH, 2012). The California Office of Environmental Health Hazard Assessment has set a Public Health Goal for 123-TCP of 0.0007 µg/L.

Ethylene dibromide, a related fumigant banned in the 1980’s, has also been detected in at least one public water supply well and several domestic wells in the Atwater/Livingston area.

Trichloroethylene

Trichloroethylene (TCE) is a volatile organic compound (VOC) used as a solvent for dyes, rug cleaners, and as a degreaser for metal parts. The MCL for TCE is 0.005 mg/L due to carcinogenicity.

TCE has been detected at levels exceeding the MCL in two locations in the Merced Subbasin. These areas, the Castle Airport Aviation and Development Center and the City of Merced’s Eastern Industrial Park, are both undergoing remediation activities.

Perchloroethylene

Perchloroethyene (PCE), which is also a VOC, has been detected in isolated public water supply wells within the Merced Subbasin. This contaminant is typically associated with industrial wastewater and dry-cleaning operations.

2.7.2 Surface Water Quality

Surface water quality varies throughout the Region, and is dependent upon climate, geology, and land use. In general, surface water quality within the Region is moderately impacted by salinity, as agriculture and the Delta-Mendota Canal may contribute to salinity intrusion in close proximity to the San Joaquin River. However, moving from east to west (toward the valley floor), water quality tends to be poorer due to diversions and regulations that decrease flows and due to agricultural return flows that may contain pollutants.

Samples of Merced River water collected near the Crocker-Huffman Diversion Dam between September 2011 and December 2012 indicate that Merced River water is mostly calcium-bicarbonate type water, which is typical of most surface water derived from Sierra Nevada sources.

The CVRWQCB is responsible for compiling a list of water bodies within the Sacramento River and San Joaquin River Basins that are classified as impaired according to standards set forth in the Clean Water Act. This list, also known as the 303(d) list, names specific water bodies that have water quality conditions that do not meet or are not expected to meet applicable water quality standards. Those water bodies listed on the 303(d) list must be addressed through the development of Total Maximum Daily Loads (TMDLs) that demonstrate the total mass loading of water quality constituents that may enter each water body without violating applicable water quality standards. Table 2-5 provides an overview of water bodies on the 303(d) list, as well as the corresponding pollutants and any known potential sources of pollutants.

Table 2-5: 303(d)-Listed Impaired Water Bodies within the Region

Water Body	Pollutant / Stressor	Potential Source(s)[1]
Bear Creek (from Bear Valley to San Joaquin River)	Indicator Bacteria	Unknown
	Toxicity	Unknown
Black Rascal Creek (Merced County)	Toxicity	Unknown
	Dissolved Oxygen	Unknown
	Indicator Bacteria	Unknown
Deadman Creek (Merced County)	Chlorpyrifos	Agriculture
	Indicator Bacteria	Unknown
	Toxicity	Unknown
	Dissolved Oxygen	Unknown
	Arsenic	Unknown
Deep Slough (Merced County)	pH	Unknown
Duck Slough (Merced County)	Chlorpyrifos	Agriculture
	Toxicity	Unknown
	Indicator Bacteria	Unknown
Ingalsbe Slough (tributary to Merced River)	Toxicity	Unknown
Merced River, Lower (McSwain Reservoir to San Joaquin River)	Mercury	Unknown
	Toxicity	Unknown
	Chlorpyrifos	Agriculture
	Group A Pesticides	Unknown
	Temperature, water	Unknown
Miles Creek (Merced County)	Toxicity	Unknown
	Indicator Bacteria	Unknown
	Dissolved Oxygen	Unknown
San Joaquin River (Mendota Pool to Bear Creek)	Chlorpyrifos	Unknown
	Diazinon	Unknown
	Boron	Unknown
	DDT (Dichlorodiphenyl-trichloroethane)	Unknown
	Group A Pesticides	Unknown
	Toxicity	Unknown
San Joaquin River (Bear Creek to Mud Slough)	DDT (Dichlorodiphenyl-trichloroethane)	Unknown
	Arsenic	Unknown
	Group A Pesticides	Unknown

Water Body	Pollutant / Stressor	Potential Source(s)[1]
	Toxicity	Unknown
	Diuron	Agriculture
	Mercury	Unknown
	Electrical Conductivity	Unknown
	Total Dissolved Solids	Unknown
San Joaquin River (Mud Slough to Merced River)	DDT (Dichlorodiphenyl-trichloroethane)	Unknown
	Group A Pesticides	Unknown
	Selenium	Unknown
	Boron	Unknown
	Diazinon	Unknown
	Indicator Bacteria	Unknown
	Toxicity	Unknown
	Chlorpyrifos	Unknown
	Mercury	Unknown
	Electrical Conductivity	Unknown
San Joaquin River (Merced River to Tuolumne River)	DDT (Dichlorodiphenyl-tricholoethane)	Unknown
	Mercury	Unknown
	Group A Pesticides	Unknown
	Benzenehexachloride (alpha.-BHC) or alpha-HCH	Unknown
	Chlorpyrifos	Unknown
	Toxicity	Unknown
	Dichlorodiphenyl-dichloroethylene (DDE)	Unknown
	Temperature, water	Unknown
	Electrical conductivity	Unknown
	Specific conductivity	Unknown
	Total dissolved solids	Unknown
Turner Slough (Merced County)	Toxicity	Unknown
	Indicator Bacteria	Unknown
	Oxygen, Dissolved	Unknown
	Specific Conductivity	Unknown
	Total Dissolved Solids	Unknown
Turner Slough (drains into San Joaquin River (Bear Creek to Mud Slough), Merced County)	Indicator Bacteria	Agriculture- animal
	Toxicity	Unknown

Notes:
1. The default value for potential source(s) is Unknown unless a source analysis has been performed or some other supporting information has been provided.

In 2003, the CVRWQCB instituted the Irrigated Lands Regulatory Program aimed at monitoring and setting rules for discharges from irrigated lands to waters of the State, which include natural streams and all public conveyance systems. Growers within the Region can seek coverage under the East San Joaquin River Water Quality Coalition which monitors and prepares Water Monitoring Plans. Raised canals within the Region tend to have better water quality than manmade drains and local creeks. In fact, MID facilities were designated as a low threat area by the CVRWQCB after multiple years of sampling and reporting.

2.7.3 Recycled Water Quality

Wastewater reclamation plants are operated by municipalities to treat and discharge effluent back into the Merced Region. The cities of Atwater and Merced and the community of Planada discharge treated wastewater to land under National Pollutant Discharge Elimination System (NPDES) permits. Treated water from all three treatment plants meet the discharge requirements specified by their respective NPDES permits. A review of available effluent water quality data on the California Integrated Water Quality System Project database indicates that the City of Merced is discharging sodium-bicarbonate type water and Planada is discharging calcium-bicarbonate type water. These waters are reused for agricultural purposes.

2.7.4 Stormwater Quality

The City of Atwater, City of Merced, County of Merced, and MID are co-permittees (the Merced Storm Water Group) that jointly implement a regional Storm Water Management Program covering the majority of the Region as well as a small portion north of the Region surrounding the unincorporated community of Delhi. While the Storm Water Group's Stormwater Management Program does not cover the entirety of the Region, it does address stormwater pollution within the major urban and developed areas in the Region where stormwater quality is of greatest concern (Merced Storm Water Group, 2007).

The Merced Storm Water Group's Storm Water Management Program addresses priority pollutants that are common in stormwater runoff from municipal areas, and therefore addresses the following pollutants: sediment, nutrients, organic materials, pathogens, hydrocarbons, metals, synthetic chemicals, chlorides, and trash and debris.

The Merced SWRP, which is being prepared concurrently with the 2018 MIRWMP Update, will include a more detailed discussion of stormwater quality and identify projects that may provide stormwater quality benefits to the Region.

2.7.5 Drinking Water Quality

As discussed previously, drinking water is provided within the Region via a multitude of water supply agencies. Drinking water quality is regulated through several agencies, including DDW and USEPA, entities responsible for setting MCLs for various water quality constituents to protect human health. Drinking water supplied by the Region's water purveyors to incorporated cities and unincorporated communities is therefore required to comply with state and federal drinking water quality standards.

2.8 Social and Cultural Composition

The Region is home to a diverse and growing population. The following sections describe Regional demographics.

2.8.1 Population and Housing Information

In general, population in the Region is growing at a steady rate, with average growth rates of 6.6% from 2010 to 2017 for the incorporated cities and Merced County – on par with the 6.1% rate for California as a whole (U.S. Census Bureau, 2018a). Continued population growth within the Region has the potential to impact water management as domestic water demands and wastewater generation increase. Historically, agricultural water demands have dominated in the Region, so as population increases within the Region, water supply management will need to adapt to accommodate increasing municipal and domestic needs associated with urban development (Merced County, 2007).

Table 2-6 provides an overview of population and household statistics for the incorporated cities of Merced, Atwater, and Livingston, as well as the larger unincorporated communities within the Region. As shown in this table, the average household sizes of all the cities and communities exceed the statewide average. This is likely due to the fact that average cost of living is relatively high in these communities, which is compounded by the fact that each community also has lower than State-wide average MHI. As such, people living within these communities generally have larger than average household sizes to reduce individual expenses related to housing.

Table 2-6: 2012-2016 5-Year Estimates of Population and Housing Data for the Region

City or Community	Population	Average Household Size	Housing Units	% Owner Occupied	% Rental Units
El Nido	478	3.37	142	37%	63%
Winton	11,309	3.92	2,883	51%	49%
Le Grand	1,721	3.56	483	66%	34%
Planada	4,499	3.76	1,197	56%	44%
Merced	81,461	3.16	25,443	41%	59%
Atwater	28,906	3.22	8,923	51%	49%
Livingston	13,703	4.10	3,341	60%	40%
California	**38,654,206**	**2.95**	**12,807,387**	**54.1%**	**45.9%**

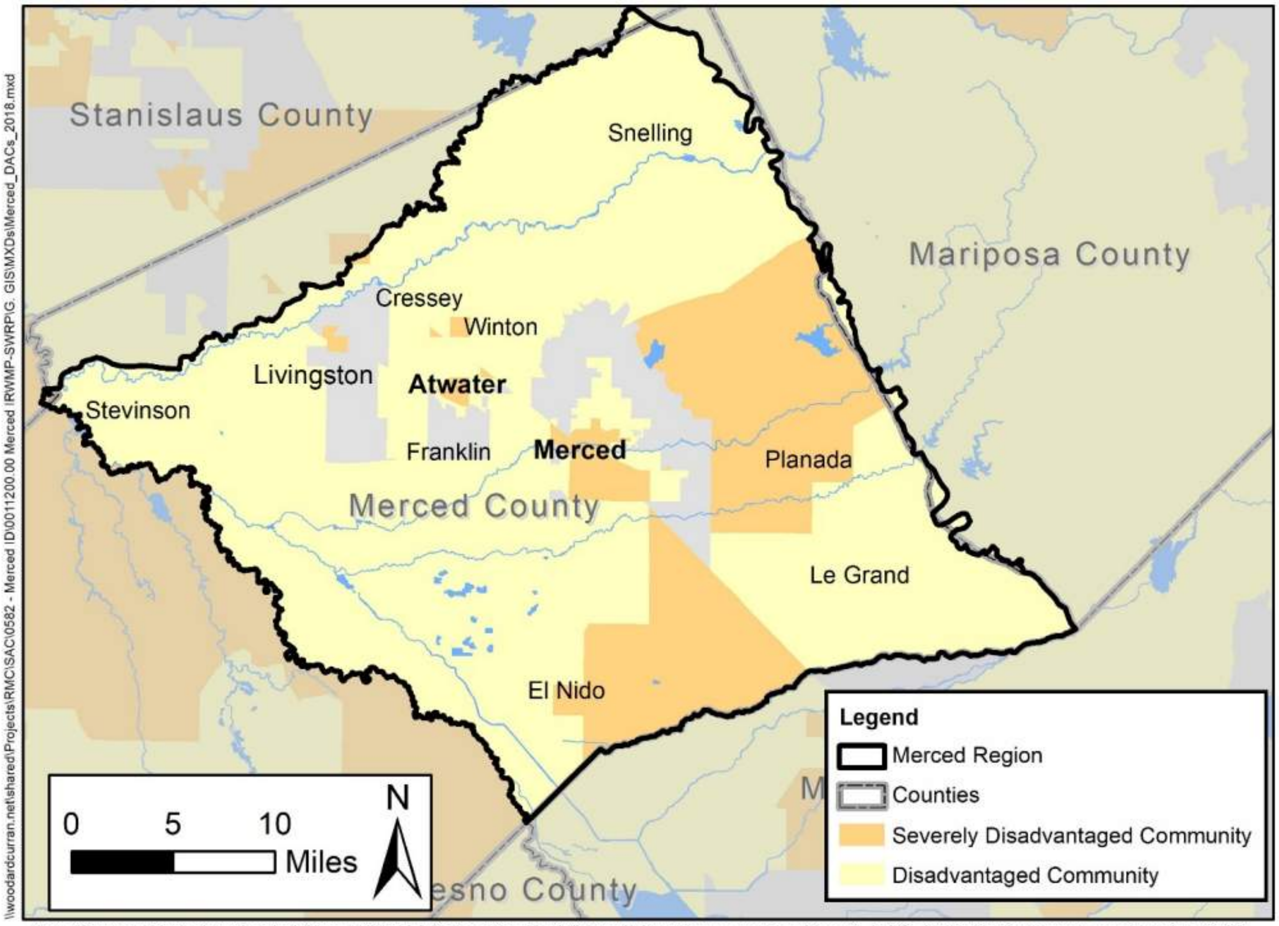
Source: U.S. Census Bureau. n.d. 2012-2016 American Community Survey 5-Year Estimates.

2.8.2 Economic Profile

A DAC is defined by the State of California as a community with an annual MHI that is less than 80% of the statewide MHI. The 2012-2016 California MHI was $63,783; therefore, communities with an average MHI of $51,026 or less are DACs by the State's definition. Communities with an average MHI of less than 60% of the Statewide MHI ($38,270) are categorized as severely disadvantaged communities, or SDACs. DACs and SDACs in the Merced Region are shown in Figure 2-13 (based on 2012-2016 ACS data provided by DWR through its DAC mapping tool [DWR, 2018a]). Based on geographic area, 92% of the Merced Region is considered a DAC. Based on MHI data at the census tract, census block group, and census designated place geographies, as well as location knowledge of economic conditions, the Merced Region considers the following communities to be DACs:

- Planada
- Winton
- Le Grand
- El Nido
- Livingston
- Merced
- Atwater
- Franklin/Beachwood
- Snelling
- Stevinson

Figure 2-13: DACs and SDACs in the Merced Region



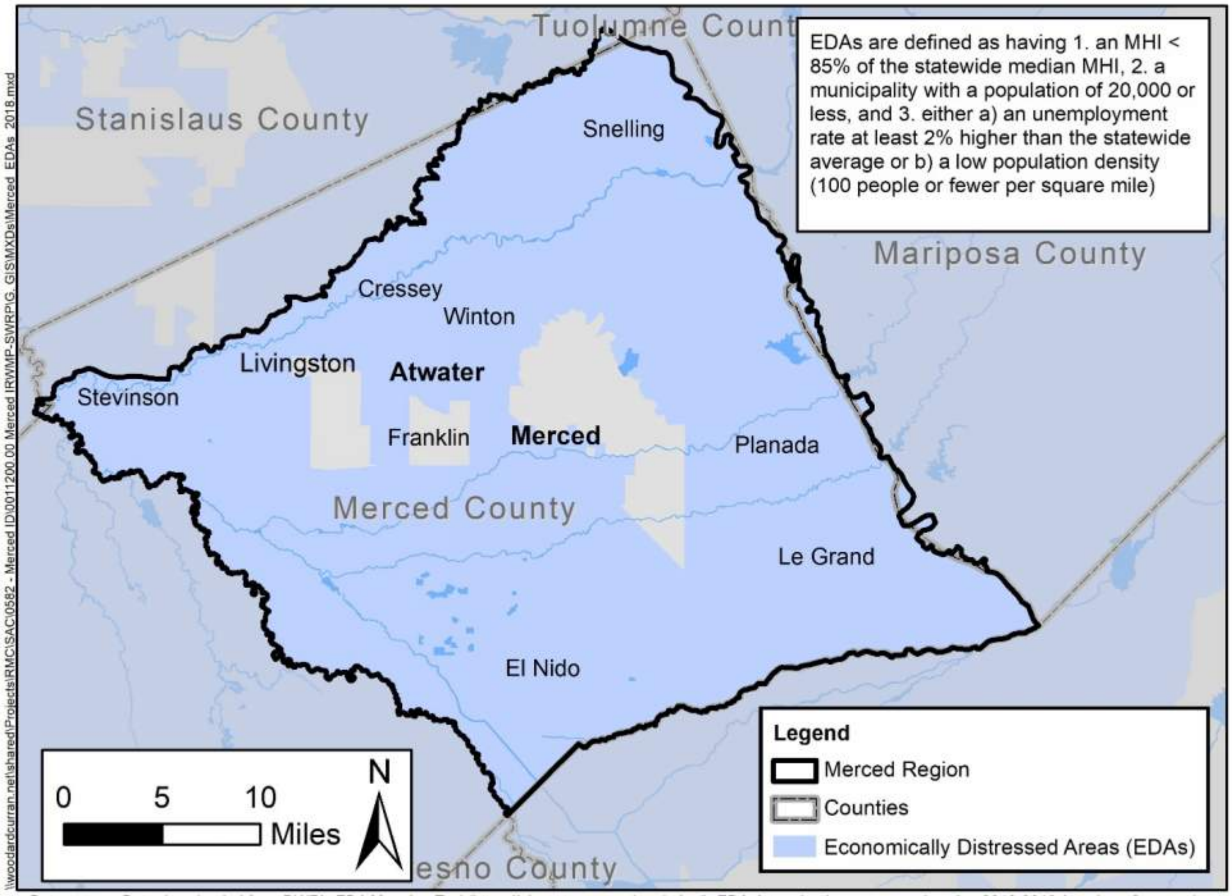
Data Source: Data downloaded from DWR DAC Mapping Tool (https://gis.water.ca.gov/app/dacs/). DAC determinations were made using 2012-2016 American Community Survey Data.

Prop 1 also designates certain areas as economically distressed areas (EDAs). As defined in Prop 1, an EDA is a "municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality where the segment of the population is 10,000 persons or less, with an annual MHI that is less than 85% of the statewide MHI, and with one or more of the following conditions as determined by the department:

1. Financial hardship
2. Unemployment rate at least two percent higher than the statewide average
3. Low population density" (CA Assembly, 2014).

Data provided through DWR's EDA mapping tool was used to identify EDAs in the Merced Region (DWR, 2018b). A municipality could quality as an EDA if it had a population less than 20,000 and an MHI less than or equal to $54,216 (85% of the California MHI). A significant portion of the Merced Region meets the EDA criteria based on either unemployment rate or population density (100 people or fewer per square mile). In total, 92% of the Region qualifies as an EDA. Figure 2-14 displays EDA areas in the Region.

Figure 2-14: EDAs in the Merced Region



Data source: Data downloaded from DWR's EDA Mapping Tool (https://gis.water.ca.gov/app/edas/). EDA determinations were made using 2012-2016 American Community Survey data and 2015 Employment Development Department data.

Table 2-7 presents economic data for the communities the Region considers to be DACs. Because such a high proportion of the Merced Region is made up of DACs and EDAs, DAC water issues largely mirror water issues within the Region as a whole. Examples of particular water issues of concern in the Merced Region are flood management and sewer service. As discussed in Section 2.3.7, portions of the Region are subject to flooding. DACs in these areas are particularly vulnerable to flooding damages that may cause temporary or permanent displacement of residents. Several unincorporated communities in the Region lack sanitary sewer infrastructure, as discussed in Section 2.3.4. DACs that rely solely on groundwater may also be more vulnerable to groundwater quality issues, especially if they lack redundant wells, the funding to treat the groundwater, or the option to use surface water.

Table 2-7: Economic Data for Merced DACs

City or Community	MHI (ACS, 2012-2016)	Unemployment Rate (ACS, 2012-2016)
Planada	$39,075	21.0%
Winton	$41,486	20.6%
Le Grand	$41,776	20.4%
El Nido	$31,957	17.7%
Livingston[1]	$55,226	11.8%
Merced	$39,307	17.2%
Atwater	$45,800	13.7%
Franklin/Beachwood	$43,741	15.9%
Snelling[1]	$49,844	21.7%
Stevinson	No data provided	20.7%

1. While the community's MHI is not less than 80% of the California MHI at the Census Designated Place level, they are considered DACs as the entire community of Snelling and a significant portion of Livingston are comprised of census tracts and census block groups that qualify as DACs.

Source: U.S. Census Bureau. 2017. 2012-2016 American Community Survey 5-Year Estimates.

2.8.3 Culture and Diversity

The Region has a well-established and growing Hispanic/Latino population, which constitutes the largest single ethnic group in Merced County as well as each of the Region's three incorporated cities. In addition, the Region has a substantial and growing Asian population that constituted approximately 21% of the City of Livingston in 2017.

Table 2-8: 2017 Ethnic Composition of the Region (based on 2017 Census Estimates)

City or Community	White	Hispanic/Latino	Asian	Other
City of Merced	29.3%	51.2%	11.8%	7.7%
City of Atwater	33.3%	55.2%	5.2%	6.3%
City of Livingston	4.3%	72.4%	20.8%	2.5%
County of Merced	27.7%	59.6%	8.0%	4.7%
California	37.2%	39.1%	15.2%	8.5%

Source: U.S. Census Bureau. 2018. 2017 Population Estimates.

2.9 Major Water Related Objectives and Conflicts

The MIRWMP is intended to be a useful future guide to the Region. As part of this process, the Region has identified major water-related conflicts and objectives, which will guide the IRWM Program as it moves forward. The objectives of the MIRWMP are presented in Chapter 4, Objectives, along with a discussion of the major water related needs that have been identified by stakeholders and which led to these objectives.

2.10 Potential Effects of Climate Change on the Region

Potential effects of climate change on the Region are discussed in detail in Chapter 16, Climate Change. Chapter 16 provides an overview of statewide climate change observation and projections, legislative background, regional climate change impacts, and regional vulnerabilities.

Merced Integrated Regional Water Management Plan

Chapter 3 Governance

This chapter addresses the Integrated Regional Water Management (IRWM) Governance Plan Standard, which requires IRWM Plans to:

- ✓ Document a governance structure that ensures the IRWM Plan will be updated and implemented beyond existing State grant programs.
- ✓ Discuss whether or how Native American tribes will participate in the RWMG.
- ✓ Describe the RWMG responsible for development and implementation of the Plan and explain how the RWMG meets the California Water Code definition.
- ✓ Identify the RWMG and individual project proponents who adopted the Plan.
- ✓ Describe how the chosen governance addresses public involvement, effective decision making, balanced access and opportunity for participation, effective communication, long-term implementation, coordination with neighboring IRWM regions and State and federal agencies, collaboration and process for updating the Plan.

The California Water Code defines a Regional Water Management Group (RWMG) as: “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 other persons who may be necessary for the development and implementation of a plan that meets the requirements of California Water Code §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.”

The Merced IRWM planning process was initiated in 2008 by a RWMG consisting of MAGPI - a consortium of municipal and agricultural water purveyors and other interest groups that includes most of the agencies with water supply, water quality and water management authority in the Region. MAGPI had been meeting since 1997 to develop technical data and management strategies to improve the health of the Region’s groundwater basin. In 2008, MAGPI established a subcommittee to encourage cooperative planning among additional aspects of water resources management beyond groundwater management and to lay the groundwork for development of the MIRWMP. This subcommittee completed the IRWM program RAP application in April 2009, which resulted in the approval of the Merced IRWM regional boundary. In February 2012, MAGPI secured a DWR IRWM Planning Grant to develop the first Merced IRWM Plan (MIRWMP) which was finalized in 2013.

In 2016, a JPA, known as MIRWMA was formed to assume responsibility for continued IRWMP Updates. In coordination with a 16-member Regional Advisory Council (RAC), MIRWMA developed this MIRWMP, which includes a long-term governance structure for continued planning and implementation of the plan.

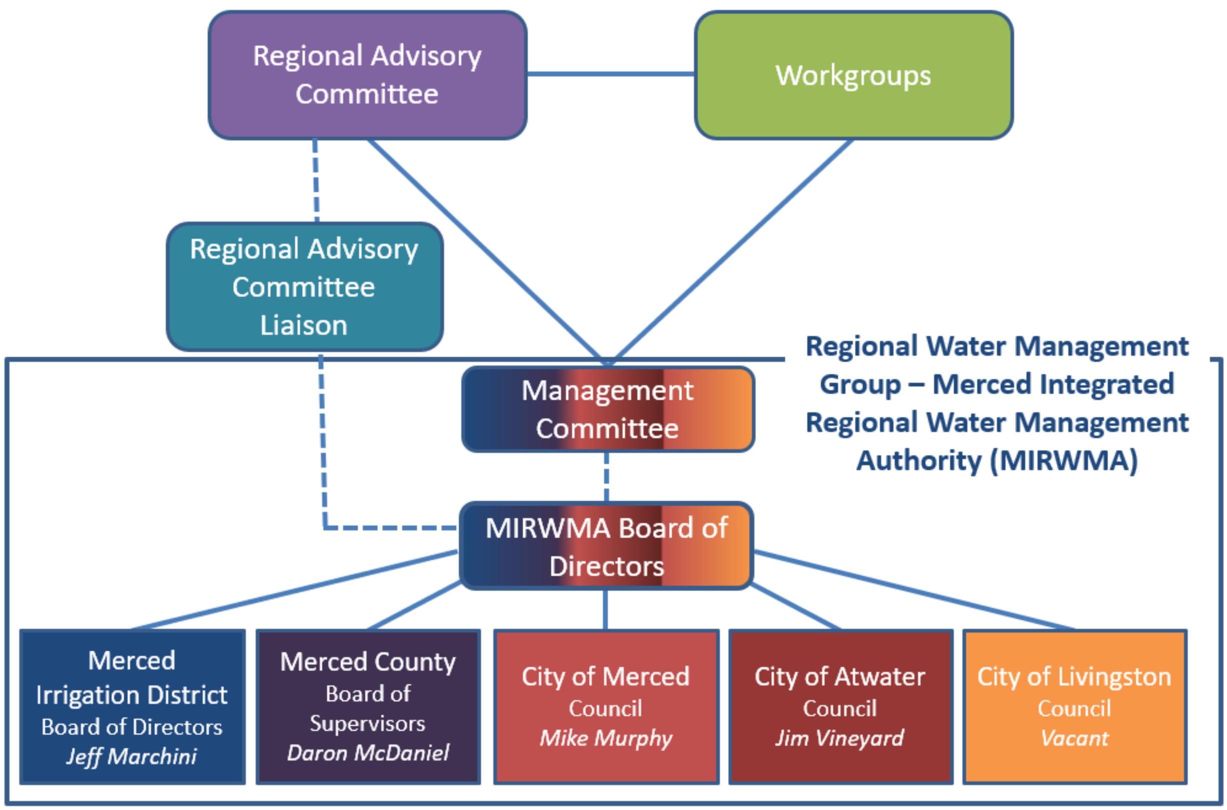
3.1 Long-Term Governance Structure

The long-term governance structure for the Region, illustrated in Figure 3-1, consists of the following entities.

- A long-term RAC that represents the broad water-related interests of the Region and reviews regional water management issues and needs, plans, projects, and work products developed through the ongoing planning process.
- Workgroups formed on an as-needed basis to address specific IRWM planning needs at the request of the RAC.
- A long-term RWMG (referred to as MIRWMA), including MID, Merced County, and the Cities of Merced, Livingston, and Atwater, that is responsible for overall direction, funding and approval for the IRWM planning process; the governing bodies of the RWMG member agencies collectively form the governing body of the RWMG, and elected officials and staff members from each of the RWMG member agencies coordinate through the committees of the RWMG.
- A Management Committee, comprised of staff from each RWMG member agency, responsible for managing the day-to-day business of the IRWM planning program.
- The MIRWMA Board of Directors, comprised of one official from each RWMG member agency, tasked with advising the RWMG governing bodies on IRWM-related business and policy based on recommendations of the RAC and Management Committee.

Each of these entities is described further in the following sections.

Figure 3-1: Merced IRWM Governance Structure



3.1.1 Regional Water Management Group

The RWMG administers and manages the IRWM planning process with the RAC in an advisory role. The RWMG is described in this section along with an explanation of its relationship with the RAC. The RAC is described in greater detail in Section 3.2.

The governance structure includes a RWMG, formed as a JPA, resulting in the MIRWMA as previously described. Collectively, these agencies have jurisdiction over all of the incorporated and unincorporated areas of the Region and associated interests of both urban and agricultural communities in the Region. All five of these entities have statutory authority over water supply and management.

Water management responsibilities of each of the RWMG member agencies are described below:

- Merced Irrigation District – MID manages various water facilities in eastern Merced County. MID was formed in 1919 pursuant to the Irrigation District Law contained in California Water Code §20500 *et. seq* and is governed by a five-member elected Board of Directors. Each director is elected from the district in which he or she resides. MID's water management responsibilities include water supply, storm drainage, flood management on the Merced River, environmental uses of water and recreational uses of water. MID is also negotiating a recycled water exchange proposal with the City of Merced.
- Merced County – As described in Chapter 2, Region Description, the Merced Region is comprised of the northeastern portion of Merced County. Merced County is a general-law county that operates under the provisions of California State law and is governed by a five-member elected Board of Supervisors. Each supervisor is elected from the district in which he or she resides. The County's water management responsibilities include storm drainage, flood management, and recreational uses of water.
- City of Merced – The City of Merced is the largest of the three incorporated cities in the Region, serving a population of approximately 84,000 people. Incorporated in 1889, Merced is a charter city that operates under the Council-Manager form of government in which the elected City Council is responsible for legislation. The Merced City Council consists of a mayor and six City Council members who are elected at large. The City of Merced's water management responsibilities include water supply, wastewater collection and treatment, storm drainage, flood management, environmental uses of water, and recycled water.
- City of Atwater – The City of Atwater is the second largest of the three incorporated cities in the Region, serving a population of approximately 28,000 people. Incorporated August 16, 1922, Atwater is a general-law city that operates under California State law and is governed by an elected City Council, which consists of a mayor and four council members. The mayor is directly elected by the voters and the council members are elected at large. The City of Atwater's water management responsibilities include water supply, wastewater collection and treatment, storm drainage, flood management, and recycled water.
- City of Livingston – The City of Livingston is the third largest of the incorporated cities in the Region, serving a population of approximately 14,000 people. Incorporated September 11, 1922, Livingston is a general-law city that is governed by an elected City Council, consisting of a mayor and four council members. The City of Livingston's water management responsibilities include water supply, wastewater collection and treatment, and storm drainage.

The RWMG was formalized in 2016 through development of a JPA, MIRWMA. The RWMG member agencies are envisioned to be equal partners in management of the MIRWMP and will be responsible for managing the Merced IRWM program indefinitely. The organization of the RWMG may evolve based on advisement by the long-term RAC and discussion among the RWMG member agencies. The RWMG's commitment to the implementation of this MIRWMP will be formalized through the adoption of the MIRWMP by each of the RWMG member agencies.

No state- or federally-recognized Native American tribal communities were identified in the Region. Should any be identified in the future, the governance structure would be revisited to provide for their participation in the IRWMP.

3.1.2 Management Committee

The Management Committee is comprised of staff from each of the RWMG member agencies, which is includes MID, Merced County and the Cities of Merced, Atwater and Livingston. Current members are listed in Table 3-1.

Table 3-1: Current Management Committee Members

Representative	Agency
Justin Vinson	City of Atwater
Jose Antonio Ramirez	City of Livingston
Stephanie Dietz	City of Merced
Ken Elwin	City of Merced
Lacey Kiriakou	Merced County
Hicham Eltal	Merced Irrigation District
Daniel Chavez	Planada CSD
Cynthia Benavidez	Le Grand CSD

The Management Committee serves as a bridge between the management and planning sides of the IRWM program. The Management Committee meets as needed to discuss the status of the IRWM program, coordinate day-to-day business needs, organize meetings of the RWMG, and address coordination needs for the RAC meetings, which will occur monthly or as necessary.

Management Committee members, while responsible for attending and/or supporting MIRWMA Board of Directors and RAC meetings, are not members of either of these committees. The role of the Management Committee members is to facilitate meetings and to provide their respective governing bodies with the information and recommendations needed to make informed program decisions. Management Committee members support RAC meetings by providing information to support RAC decision-making and share RWMG member agency perspectives. As nonvoting participants at RAC meetings, the Management Committee members are in a position to provide suggestions and offer feedback related to the feasibility of RAC recommendations; however, recommendations of the Management Committee remain independent from recommendations of the RAC.

3.1.3 MIRWMA Board of Directors

The MIRWMA Board of Directors (Board) includes one elected official from each RWMG member agency. Each RWMG member agency has sole discretion to appoint its own representative to the Board; however, the intent is for each Board member to be an elected member of the RWMG agency's governing board or council. The Merced County Board of Supervisors representative on the MIRWMA Board should be a Supervisor that represents a community within the Region (Districts 1 through 4). Current MIRWMA Board members are listed in Table 3-2.

Table 3-2: Current Policy Committee Members

Representative	Agency
Jim Vineyard	City of Atwater
Vacant	City of Livingston
Mike Murphy	City of Merced
Daron McDaniel	Merced County
Jeff Marchini	Merced Irrigation District

The MIRWMA Board is responsible for maintaining coordination among the RAC and RWMG agency governing bodies regarding the IRWM program, providing feedback to the Management Committee and RAC, making critical IRWM-related policy decisions based on recommendations from the RAC, and reporting to their respective Boards or Councils on the status of the Merced IRWM program. Additionally, in the future, should changes to the governance structure be desired, the MIRWMA Board will be responsible for evaluating potential changes. To fulfill these duties, the MIRWMA Board will meet approximately twice per year or as necessary.

Meetings of the MIRWMA Board are open to the public and include participation from each MIRWMA Board member, Management Committee members, and a RAC member appointed by the RAC to serve as a liaison to the MIRWMA Board. In addition to facilitating the MIRWMA Board meetings, Management Committee members participate in MIRWMA Board meetings to provide staff recommendations as appropriate. The RAC liaison also participates, communicating RAC recommendations directly to the MIRWMA Board.

3.2 Regional Advisory Committee

During the preparation of the 2013 MRIWMP, an interim RAC was formed to assist in completing the MIRWMP. Members of the RAC were recruited through an open invitation process that was publicly advertised by MID, Merced County and the City of Merced. All parties that applied for inclusion on the RAC were formally appointed by the MID Board of Directors as either full or alternate members of the RAC. For the 2018 MIRWMP Update, RAC membership was updated via outreach to the members of the interim RAC. RAC members were approved by the MIRWMA board. The RAC includes 16 members representing broad interests and perspectives in the Region related to water management, land use, natural resources and community stewardship. The interests represented by the RAC include:

- Water Supply Interests
- Wastewater Interests
- Stormwater Interests

- Flood Control Interests
- Local Government
- Agricultural Interests
- Other Business Interests (non-agriculture)
- Environmental Interests
- Other Institutional Interests (e.g. UC Merced)
- DAC and Environmental Justice (EJ) Interests
- Recreational Interests
- Community / Neighborhood Interests

During development and update of the MIRWMP, the RAC met on a monthly basis to review progress and provide comments and guidance on key plan elements, including recommendations for the MIRWMP governance structure. After the MIRWMP Update, the RAC will meet on an approximately quarterly basis, or as needed, to provide guidance on upcoming IRWM planning and funding activities and educate participants on water resources-related topics.

The RAC met regularly throughout MIRWMP development to provide guidance on IRWM planning and funding activities and to educate participants on water resources-related topics.

The RAC may be reformulated as needed to provide for continued representation of the broad interests of the Region in long-term water resources planning. RAC members are encouraged to participate in Merced IRWM planning over the long-term; however, current participants are not obligated to continue participation indefinitely.

A succession policy was developed by the RAC and endorsed by the RWMG to dictate how RAC replacements will be appointed, should a RAC member need to step down for any reason. This policy is described in the RAC charter, provided as Appendix A. If interested, other agencies may join the RWMG by following the process laid out in the JPA Agreement. New members must be public agencies and must be voted in by existing members. New agencies may join after they execute an agreement to be bound by the terms of the JPA.

3.3 Workgroups

Two types of workgroups may be established: standing workgroups and ad-hoc workgroups.

Standing workgroups may be convened to deal with ongoing RAC business. In contrast, ad-hoc workgroups will be formed, as needed, to carry out discrete tasks such as project selection for funding opportunities, review of proposed legislation, and other actions. The purpose of ad-hoc workgroups is to enable participants in the IRWM program to work through topics requiring intensive discussions and evaluation to develop recommendations for the larger group. The process for convening and managing workgroups is described in the RAC charter, provided as Appendix A.

3.4 Entities Adopting the MIRWMP

Adoption of the MIRWMP is the formal acceptance of the plan and indicates support of the Merced IRWM program. At a minimum, the governing body of each RWMG agency must adopt the MIRWMP. Other agencies that desire to formally indicate their support for the MIRWMP are also encouraged to adopt the plan. As members of the RWMG, the following agencies have adopted the 2018 IRWMP: the Cities of Merced, Atwater, and Livingston, Merced County, and MID. Adopting resolutions are included in Appendix B.

Additional entities that will adopt the 2018 MIRWMP Update include all entities interested in pursuing grant funding relating to their agency or entity. Adoption of the MIRWMP by additional agencies, such as project proponents, may occur at later dates. Any agencies who wish to join the RWMG will be required to adopt the plan just as any other RWMG member.

3.5 Public Involvement

Engagement of stakeholders and members of the general public, in addition to RAC members, is integral to the IRWM planning and implementation process. Stakeholder outreach began early in the development of the MIRWMP. The MIRWMP has benefitted from the legacy of MAGPI's established relationships with various stakeholders such as water purveyors; wastewater agencies; flood management agencies; municipal, county government and special districts; land use authorities; self-supplied water users; environmental stewardship organizations; community and landowner organizations; industry organizations; state, federal and regional agencies; colleges and universities; DACs; and other interests in the area. The 2013 MIRWMP stakeholder list, which included stakeholders previously identified by MAGPI, was used as a starting point for public outreach during the 2018 MIRWMP Update. During update of the MIRWMP, the RWMG continued to reach out to interested parties by contacting potential project proponents and hosting two public workshops. The workshops were advertised through multiple outlets including newspaper advertisements, web postings, e-mail distribution lists, and personal communication with potential project proponents.

Public workshops are held during critical junctures in the IRWM program.

Stakeholder involvement in key program decisions will remain a priority for ongoing IRWM planning and implementation. The RWMG will continue to host public workshops at critical junctures in the program (e.g. plan updates, calls for projects), and news and events related to the program will continue to be posted on the Merced IRWMP website (www.mercedirwmp.org) and the websites of RWMG member agencies. Stakeholder involvement is discussed in greater detail in Chapter 14.

3.6 Decision-Making Process

The RWMG maintains overall decision-making authority for the MIRWMP and planning process. Before bringing the action before the RWMG Boards or Councils, MIRWMA Board representatives will be responsible for discussing relevant issues with the Management Committee members and the RAC liaison at the MIRWMA Board level (MIRWMA Board meetings discussed in Section 3.1.3 provide a forum for these discussions).

Day-to-day management will be accomplished by the Management Committee, and the RAC will be the primary forum for discussion and information exchange on regional water management topics among community representatives.

The RAC decision-making process is described in the RAC charter, provided as Appendix A.

3.7 Communication

Key IRWM program decisions will be made following thorough discussion and vetting by all interested parties. At RAC meetings, members and alternates assume responsibility for raising issues, concerns, and ideas from their communities and constituents who are not able to attend the meetings. RAC members are also expected to inform and educate constituents of the information and discussions from each meeting.

Information will continue to be conveyed to the general public through the Merced IRWMP website (www.mercedirwmp.org), RWMG partner agency websites and media releases, as appropriate.

3.8 Coordination

The Merced Region is bordered by five other IRWM regions: the Madera Region, Yosemite-Mariposa Region, East Stanislaus Region, Tuolumne-Stanislaus Region, and Westside-San Joaquin Region. While cooperation with the adjacent regions has not been formalized, representatives of the Merced Region routinely attend meetings of the Yosemite-Mariposa Region to maintain ongoing communication and coordination. Additionally, staff members from Merced County and MID routinely meet with members of the Turlock Groundwater Basin Association which manages groundwater activities in the East Stanislaus Region. The Merced Region also coordinates with other Regions in the San Joaquin River Funding Area as needed, such as during preparation of the Disadvantaged Community Involvement Program grant proposal and funding area-wide DAC Needs Assessment.

The Merced Region coordinates with State and federal agencies through funding secured from these agencies. When funding is received from a State or federal agency, ongoing coordination is required during and following project implementation. For example, the Merced Region was awarded grant funds through Prop 84 in 2014, which required execution of a grant agreement between the MID (the grantee) and DWR. MID engaged in ongoing coordination with the State by submitting deliverables as stipulated in the grant agreement. The Region also coordinates with State and federal agencies during permitting processes. As projects are implemented, they will require permits from various State and federal bodies, in addition to environmental documentation. Projects will comply with CEQA and the National Environmental Policy Act (NEPA) as required; the environmental documentation process will also require coordination with multiple State and federal agencies.

The Merced Region is also coordinating directly with DWR through the IRWM process and the DAC Involvement Grant for the San Joaquin River Funding Area. Additionally, coordination with DWR is occurring under SGMA as GSAs work to prepare GSPs. The Merced Region overlies three groundwater subbasins – Turlock, Merced, and Chowchilla – and agencies throughout the Region are coordinating with GSAs on SGMA compliance.

3.9 Plan Updates

The MIRWMP is intended to be a living document, requiring periodic updates. The current MIRWMP provides guidance for developing and refining water resources projects at the local level for a 20-year planning horizon based on current regional objectives, priorities, and water management strategies. Recognizing that regional conditions will change within the Plan’s 20-year timeframe, the RWMG and RAC appreciate the need to continue to hold regular meetings. Through these meetings, MIRWMP stakeholders will continue to discuss and coordinate on critical water-related needs to determine whether shifts in regional objectives or priorities are needed to maintain currency with local conditions and needs. When changes are dictated, the RWMG, in consultation with the RAC, will prepare amendments or full updates to the MIRWMP, as appropriate. Changes to the State’s IRWM planning framework may also necessitate updates to the MIRWMP, and continuation of the RWMG and RAC collaboration will ensure the Region is prepared to respond to future changes. The project list, accessible through the MIRWMP website, is a living document and can be updated in real-time without requiring a full Plan update or re-adoption.

Chapter 4 Objectives

This chapter addresses the Integrated Regional Water Management (IRWM) Objectives Plan Standard which requires IRWMPs to:

- ✓ Present plan objectives, which must address major water-related issues and conflicts of the region and must be measurable by some practical means so achievement of objectives can be monitored
- ✓ Describe the process used to develop the objectives
- ✓ Contain an explanation of the prioritization or reason why the objectives are not prioritized
- ✓ Consider climate change, including: changes in the amount, intensity, timing, quality, and variability of runoff and recharge; sea level rise effects; and climate change adaptation and mitigation measures

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The RAC developed 12 specific IRWMP objectives to address regional water management needs and issues. Detailed descriptions and the rationale for development and inclusion of each objective are presented in the following sections.

IRWMP Objectives

A. Correct groundwater overdraft conditions.

B. Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management.

C. Meet demands for all uses, including agriculture, urban, and environmental resource needs.

D. Improve coordination of land use and water resources planning.

E. Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure.

F. Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible.

G. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.

H. Protect, restore, and improve natural resources.

I. Address water-related needs of disadvantaged communities (DACs).

J. Protect and enhance water-associated recreation opportunities.

K. Establish and maintain effective communication among water resource stakeholders in the Region.

L. Enhance public understanding of water management issues and needs.

Of the 12 IRWM objectives listed above, the RAC identified Objectives A, B and C as the highest priority objectives for the Region. The following sections summarize water management needs in the Region and the process for developing and prioritizing objectives to address these needs. In addition, measurable performance measures are presented, which will be used to assess the Region’s progress in achieving each objective.

4.1 Regional Water Management Issues

Water management issues in the Merced Region were identified by reviewing existing water management plans in the Region and brainstorming with the RAC, which represents a broad cross-section of water management interests throughout the Region. In addition, during preparation of the 2013 MIRWMP, a series of technical workshops were held focusing on water conservation, groundwater recharge, salt and nutrient management, climate change, and integrated flood management. These workshops, which were publicly noticed and announced through media vehicles including newspaper advertisements and local radio announcements, were open to all interested stakeholders. A key focus of these meetings was to identify specific water management issues in the Region and develop objectives to address those issues Based on input from the RAC and stakeholders, a list of regional water management issues were identified. The RAC reviewed these issues again during the 2018 MIRWMP update as the draft chapters were prepared; no changes were made to the list. The following list describes the issues identified in the Merced Region.

- **Inadequate flood control.** Some creeks, such as Black Rascal Creek, have little or no flood control infrastructure in place. Improved flood management should be coordinated with surface storage and/or recharge facilities to maximize use of local supplies. For example, flood flows could be diverted to agricultural lands or to recharge areas in the southeastern portion of the Region with sandy soils. The Region currently employs groundwater recharge basins; similar projects could be implemented to provide additional flood control benefits. The Merced Region is preparing a SWRP concurrently with this IRWMP; projects identified in the SWRP may provide potential flood management solutions.
- **Lack of holistic water management.** The Region is constantly striving to improve sustainability in water resource management. For example, there are opportunities to improve current water use patterns to enhance the health of the groundwater basin. Converting existing groundwater irrigators to surface water within irrigation or water districts that enjoy surface water rights could result in groundwater basin recharge as opposed to contributing to overdraft conditions. The Region could also benefit from an overall policy aimed at planning, financing and operating recharge basins in coordination with surface water purchases made specifically for recharge purposes; the basis of this policy should be agreed-upon scientific recommendations. A long-term view must be taken in planning efforts to prevent water management policies from being heavily impacted by political will and other short-term influences. Implementation of SGMA will help the Region move toward holistic water management of the Region’s groundwater resources.
- **Failure to protect supply.** Until the passage of SGMA, there was no statewide framework ensuring that groundwater basins would be managed sustainably for all uses. Regulatory agencies have also historically had minimal control over private use of groundwater supplies despite overdraft conditions. Due to these conditions, the Region’s groundwater basins have suffered, and in 2016, the Merced and Chowchilla Subbasins were categorized as critically overdrafted by DWR. All groundwater basins within the Merced Region were classified as high-priority based on CASGEM rankings. Under SGMA, the use and protection of groundwater basins is changing and the Region will be required to take steps toward sustainably managing its groundwater basins. An additional concern for the Region is that the SWRCB has proposed reductions in the allowable surface diversions from the Merced River, which impacts the Region’s ability to conjunctively manage supplies.

- **Need for better groundwater information and management.** There is a need for better information related to current groundwater conditions and management actions necessary to maintain the health of the basin for all water users. Water users need to understand how their water use impacts the basin as a whole. As noted above, SGMA will likely play an important role in remedying this issue.
- **Need for groundwater recharge.** There is currently a limited number of managed groundwater recharge operations in the Region. Opportunities to increase groundwater recharge in areas that are determined to be most conducive for recharge should be explored, including opportunities to recharge flood waters. The Merced Region SWRP may also identify opportunities for groundwater recharge using stormwater.
- **Disconnect between land use planning and water management planning.** The Merced Subbasin, which serves the majority of demands in the Merced Region, is in overdraft; however, significant population growth is projected. In addition, throughout the Merced Region, rangelands and lands being used for purposes with relatively low water demands are being converted to more water-intensive land uses such as irrigated agriculture. Improved coordination between water and land use management is needed to ensure that future development is sustainable.
- **Inefficient water use practices.** Improved water use efficiency could reduce the mismatch between water demands and available supplies. Onsite water reuse, effective use of stormwater and flood flows, increased water conservation, and improved water use efficiency should be explored.
- **Water quality impacts.** Water quality in the Region is being impacted by saline intrusion from groundwater near the San Joaquin River, the use of pesticides and herbicides in the Region, mining impacts, fracking occurring in the grasslands area, urban runoff, and legacy nitrate issues. Emerging contaminants such as pharmaceuticals and personal care products must also be considered. Practices such as deep-well injection of wastewater (currently being practiced in the Hilmar area) must be managed to prevent potential water quality impacts.
- **Inadequate wastewater management.** Wastewater collection and treatment capacity is limited in many parts of the Region. Adequate wastewater collection and treatment is necessary to protect water quality.
- **Impacts to sensitive ecosystems.** Lower groundwater levels impact environmental resources. For example, protecting vernal pools in eastern Merced County requires adequate water supply. Groundwater levels are also important for sustaining streamflows. Rerouting flows from areas prone to flooding to areas where water levels have been decreasing can improve habitat.
- **Funding challenges.** Water management projects cannot be implemented without funding, and it can be difficult to raise water rates for needed projects. As such, long-term financing alternatives should be explored.
- **Lack of public understanding of water management.** There is a need to educate the general public on issues related to local hydrology, water management, and the potential and need for enhanced water use efficiency. Cultural differences play a role in how water is valued and managed. Public education efforts must consider these cultural differences.

4.2 Process to Develop Objectives

A set of objectives was developed to address the water management issues identified above. For each objective, performance measures were identified. Performance measures are benchmarks that can be used to measure the Region's progress toward achieving each objective. The MIRWMP objectives were first developed for the 2013 MIRWMP through a series of facilitated workshops and meetings that were advertised and open to the public, including:

- Three RAC meetings
- Five technical workshops, focused on water conservation, groundwater recharge, salt and nutrient management, climate change and flood management
- One general public meeting

In addition, local water and land use management plans were reviewed to identify local planning objectives that may be appropriate to include in the MIRWMP. Objectives identified in local planning documents are summarized in Appendix C to this document. The RAC revisited the objectives during an in-person meeting in May 2018, and through a consensus-based approach agreed to make minor updates to the objectives for the 2018 MIRWMP Update. These updates were largely made in response to changes in the IRWM Plan Standards and current day conditions.

4.3 Water Management Objectives

Using the process outlined above, the RAC established the MIRWMP objectives and performance measures in Table 4-1. The objectives represent the RAC's long-term aspirations for the Region. The RAC recognizes that attainment of these objectives necessitates incremental improvements implemented over multiple years. Furthermore, the RAC has acknowledged that, in some cases, the ideal set by the IRWMP objectives may prove to be technically or economically infeasible, but the objectives provide a long-term direction towards which the Region desires to move and will attempt to meet to the greatest extent possible. As regional stakeholders strive towards these long-term goals, the performance measures provide a practical means for the Region to monitor the incremental improvement from year to year.

Table 4-1: MIRWMP Objectives

Long-Term Objectives for the Merced Region	Performance Measures
A. Correct groundwater overdraft conditions, promote direct and in-lieu recharge, and identify supplemental water.	1. Groundwater surface elevation 2. Volume of water recharged 3. Reduction in groundwater subsidence 4. Improvement in groundwater quality
B. Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management.	1. Occurrence of flooding at the Bear Creek, Black Rascal Creek diversion, Deadman Creek, Dry Creek, Fahrens Creek, Lake Yosemite, Mariposa Creek, Merced River, and San Joaquin River 2. Volume of flood water stored and/or recharged 3. Flood-related damages (extent and frequency)

Long-Term Objectives for the Merced Region	Performance Measures
C. Meet demands for all uses, including agriculture, urban, and environmental resource needs.	1. Curtailment of voluntary and/or mandatory water use restrictions 2. Stability of groundwater levels 3. Ability to meet instream flow requirements
D. Improve coordination of land use and water resources planning.	1. Number of cooperative planning meetings held between land use and water resource planning entities 2. Number of General Plans with water resource elements
E. Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure.	1. Number of projects implemented that address climate change
F. Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible.	1. Estimated annual savings from demand management programs 2. Volume of water per year put to beneficial reuse 3. Percent of water users with meters and commodity pricing 4. Urban per capita water use (in accordance with provisions of SBx7-7)
G. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	1. New 303(d) listings and/or delistings 2. Surface water and groundwater quality
H. Protect, restore, and improve natural resources.	1. Acres of habitat protection / restoration / enhancement completed 2. Development trends in the largest and most ecologically sensitive areas of Merced County (including the Merced and San Joaquin River corridors and Eastside Grasslands)
I. Address water-related needs of disadvantaged communities (DACs).	1. Programs implemented that focus on meeting critical water-related needs of DACs 2. Percent of population with drinking water that complies with all applicable standards
J. Protect and enhance water-associated recreation opportunities.	1. Number of programs that include water-associated recreation opportunities

Long-Term Objectives for the Merced Region	Performance Measures
K. Establish and maintain effective communication among water resource stakeholders in the Region.	1. Number of stakeholders or their representatives and members of the public attending IRWM-related meetings 2. Number of collaborative projects jointly implemented by multiple entities
L. Enhance public understanding of water management issues and needs.	1. Number of educational programs / number of people participating in water-focused educational events in the Region

Table 4-2 identifies the basis for each of the MIRWMP objectives. In most cases these objectives were developed to address one or more of the regional water management issues identified in Section 4.1, Regional Water Management Issues. Some of the objectives were added primarily in consideration of the IRWM Guidelines.

Table 4-2: Basis of the MIRWMP Objectives

MIRWMP Objective	Basis
A. Correct groundwater overdraft conditions, promote direct and in-lieu recharge, and identify supplemental water.	This recognizes the need to improve current water use patterns to enhance the health of the groundwater basin and the need to increase recharge opportunities. This was identified by the RAC as one of the Region's highest priorities. This objective also addresses adapting to changes in the amount, intensity, timing, quality, and variability of runoff and recharge, as required by the 2016 IRWM Guidelines.
B. Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management.	This objective addresses the Region's challenge of inadequate flood control and promotes an integrated approach to stormwater and flood management. This objective also addresses adapting to changes in the amount, intensity, timing, quality, and variability of runoff and recharge, as required by the 2016 IRWM Guidelines. This objective includes consideration of one of the water-related greenhouse gas (GHG) emission reduction strategies identified in the California Air Resources Board (CARB) AB 32 Scoping plan: reuse of urban runoff.
C. Meet demands for all uses, including agriculture, urban, and environmental resource needs.	This objective addresses the Region's need to provide a long-term, holistic approach to the management of the Region's water resources. The objective requires a sustainable and coordinated approach among water management agencies to meet the Region's various demands. The RAC identified this objective as one of the most challenging to meet given the economic and technical

MIRWMP Objective	Basis
	challenges of meeting all demands with limited supplies, but it is an ideal towards which the Region will strive.
D. Improve coordination of land use and water resources planning.	This objective addresses the Region's disconnect between land use management and water management. The objective is intended to ensure that future development is sustainable.
E. Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure.	The Region has identified several water management areas that are vulnerable to the potential impacts of climate change. This objective supports climate change mitigation and/or adaptation actions that would reduce the Region's vulnerability to potential climate change impacts, including reducing energy consumption and GHG emissions, sequestering carbon, and using renewable energy. This objective includes consideration of the following water-related GHG emission reduction strategies identified in the CARB AB 32 Scoping plan: water system energy efficiency and increasing renewable energy production.
F. Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible.	This objective promotes opportunities to improve the efficiency of the Region's water use practices. The objective was developed recognizing that there are both opportunities to reduce demand as well as opportunities to use water more efficiently and minimize water waste. This objective includes consideration of the following water-related GHG emission reduction strategies identified in the CARB AB 32 Scoping plan: water use efficiency and water recycling.
G. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	This objective addresses potential water quality impacts to both the Region's groundwater and surface waters, including potential water quality impacts from areas with inadequate wastewater collection and treatment systems.
H. Protect, restore, and improve natural resources.	This objective addresses the importance of water management in preventing impacts to sensitive ecosystems. The objective encompasses the need to protect sensitive environmental resources from water-related impacts such as the effect of decreasing groundwater levels on stream flows.
I. Address water-related needs of disadvantaged communities (DACs).	The Merced Region is almost entirely classified as a DAC. As such, addressing water-related needs of DACs is of critical importance to the Region. This objective also addresses the IRWM Guidelines requirement to consider water-related needs of DACs in the area within the boundaries of the Plan.

MIRWMP Objective	Basis
J. Protect and enhance water-associated recreation opportunities.	This objective addresses the need to provide low-cost, water-related recreation opportunities that are an important resource for DACs throughout the Region. In addition, the objective recognizes the importance of providing water-related recreational opportunities despite potential trade-offs that can exist between recreation and other areas of water management such as water supply, water quality, and ecosystem restoration.
K. Establish and maintain effective communication among water resource stakeholders in the Region.	This objective addresses the importance of engaging key stakeholders and interested parties in water management decision-making to enhance coordination and collaboration in the Region. This is particularly critical to encourage the development of integrated, multi-benefit water management projects and programs.
L. Enhance public understanding of water management issues and needs.	This objective addresses the importance of public understanding of water management. The objective also assists in addressing the Region's funding challenges by increasing public understanding of the need to fund water projects.

4.4 Prioritizing Objectives

The RAC discussed the benefits and drawbacks of prioritizing objectives. Prioritizing objectives could aid in identifying core issues that all interest groups in the Region could agree upon. Prioritized objectives could then be used in the project prioritization process to help the Region identify those projects that would provide the greatest benefit to the Region as a whole. While establishing highest priority objectives indicates that some objectives are more important than others, it does not mean that the remaining high priority objectives are unimportant. All of the Merced Region IRWM objectives are important to meeting needs of the Region and are considered to be high priority objectives.

Recognizing the value of prioritizing objectives, the RAC went through an exercise at the August 2012 meeting to prioritize objectives through a simple polling approach. Each participant was asked to identify the top three objectives that were most important to him or her and rank the importance of those objectives, with one being most important and three being least important of the top three. The results of the prioritization clearly indicated that the top three priorities are the objectives associated with flood management, meeting water demands, and correcting groundwater overdraft. The participants all agreed that those three objectives reasonably represent the highest priority concerns of the Region. The prioritization of objectives was revisited for the 2018 MIRWMP Update at an in-person meeting held in May 2018. The RAC elected to keep the highest and high priority objectives the same and reached consensus on slight reorganization of the objectives within the two categories. Within each category, objectives are in order from highest to lowest priority.

The RAC's objective priority groupings are as follows:

Highest Priority Objectives

A. Correct groundwater overdraft conditions, promote direct and in-lieu recharge, and identify supplemental water.

B. Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management.

C. Meet demands for all uses, including agriculture, urban, and environmental resource needs.

High Priority Objectives

D. Improve coordination of land use and water resources planning.

E. Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure.

F. Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible.

G. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.

H. Protect, restore, and improve natural resources.

I. Address water-related needs of disadvantaged communities (DACs).

J. Protect and enhance water-associated recreation opportunities.

K. Establish and maintain effective communication among water resource stakeholders in the Region.

L. Enhance public understanding of water management issues and needs.

As projects are implemented, regulations change, and regional conditions change over time, the Region's priorities may change. The MIRWMP is a living document that will be periodically updated to reflect changing conditions.

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Chapter 5 Resource Management Strategies

This chapter addresses the Integrated Regional Water Management (IRWM) Resource Management Strategies Plan Standard which requires IRWM Plans to:

- ✓ Document the range of RMS considered to meet the IRWM objectives and identify which RMS were incorporated into the IRWM Plan
- ✓ Consider the effects of climate change on the IRWM region when considering RMS
- ✓ Consider, at a minimum, the RMS found in the California Water Plan Update 2013

A comprehensive range of resource management strategies (RMS) was considered to achieve the Merced Region's IRWM Plan objectives. This chapter identifies the RMS considered within this MIRWMP, documents the selection process used to determine appropriate RMS for the Region, and describes any existing efforts that are being taken within the Region for each RMS. In addition, this chapter includes an evaluation of RMS in the context of climate change by assessing the ability of these strategies to eliminate or minimize climate change vulnerabilities, especially those impacting water infrastructure systems. This section considers all RMS covered in the California Water Plan 2013 Update, assesses the Region's IRWM Plan objectives outlined in Chapter 4, Objectives, and determines how the RMS identified in the California Water Plan 2013 Update can work together to achieve the Region's specific IRWM Plan objectives.

5.1 Resource Management Strategies Considered

The MIRWMP considered each RMS listed in the California Water Plan Update 2013 as required by the Proposition 1 IRWM Guidelines. The California Water Plan Update 2013 identified eight categories of RMS applicable to water management in California. Table 5-1 presents the eight categories of RMS considered for the MIRWMP. Though all the RMS identified by the California Water Plan Update 2013 were considered for inclusion in the MIRWMP, not all are appropriate for meeting the Region's IRWM plan objectives. The RMS determined to be inappropriate for the Region included: conveyance-Delta, desalination, precipitation enhancement, fog collection, dewvaporation or atmospheric pressure desalination, and waterbag transport/storage technology.

Table 5-1: Resource Management Strategies Considered for the MIRWMP

Reduce Water Demand	Practice Resources Stewardship
Agricultural Water Use Efficiency	Agricultural Lands Stewardship
Urban Water Use Efficiency	Ecosystem Restoration
Improve Operational Efficiency and Transfers	Forest Management
Conveyance- Delta*	Land Use Planning and Management
Conveyance- Regional/Local	Recharge Area Protection
System Reoperation	Sediment Management
Water Transfers	Watershed Management
Increase Water Supply	**People and Water**
Conjunctive Management and Groundwater Storage	Economic Incentives (Loans, Grants and Water Pricing)
Desalination (Brackish and Sea Water)*	Outreach and Engagement
Precipitation Enhancement*	Water and Culture
Municipal Recycled Water	Water-Dependent Recreation
Surface Storage- CALFED	**Other Strategies**
Surface Storage- Regional/Local	Crop Idling for Water Transfers
Improve Water Quality	Dewvaporation or Atmospheric Pressure Desalination*
Drinking Water Treatment and Distribution	Fog Collection*
Groundwater Remediation/Aquifer Remediation	Irrigated Land Retirement
Matching Water Quality to Use	Rainfed Agriculture
Pollution Prevention	Waterbag Transport/Storage Technology*
Salt and Salinity Management	**Improve Flood Management**
Urban Stormwater Runoff Management	Flood Management

*RMS deemed inappropriate for the Merced Region

5.2 Objectives Assessment

Table 5-2 presents the RMS that were determined to be appropriate for the MIRWMP and illustrates which strategies can be implemented to achieve each objective. In many cases, multiple RMS may be implemented together – or integrated – to fulfill one or more regional objectives. This is especially applicable with Objective E, which makes it a regional priority to address climate change adaptation in water resource management and infrastructure. This objective is vast and holistic, with all RMS that are applicable to the Region at least indirectly contributing to its implementation. Descriptions of each RMS, including those not appropriate for the Region, can be found in Section 5.4.

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Table 5-2: Resource Management Strategies that Achieve MIRWMP Objectives

	Agricultural Lands Stewardship	Agricultural Water Use Efficiency	Conjunctive Mgmt and Groundwater Storage	Conveyance—Regional/Local	Crop Idling for Water Transfers	Drinking Water Treatment & Distribution	Economic Incentives	Ecosystem Restoration	Flood Management	Forest Management	Groundwater /Aquifer Remediation	Irrigated Land Retirement	Land Use Planning and Management	Matching Water Quality to Use	Municipal Recycled Water	Outreach and Engagement	Pollution Prevention	Rainfed Agriculture	Recharge Area Protection	Salt and Salinity Management	Sediment Management	Surface Storage—CALFED	Surface Storage—Regional/Local	System Reoperation	Urban Stormwater Runoff Management	Urban Water Use Efficiency	Water and Culture	Water Transfers	Water-Dependent Recreation	Watershed Management
A. Correct groundwater overdraft conditions, promote direct and in-lieu recharge, and identify supplemental water.	-	○	●	●	○	-	●	○	○	○	●	○	○	-	●	○	-	●	●	-		●	●	●	○	○	○	●	-	●
B. Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management	○	-	●	●	-	○	-	●	●	○	○	-	●	○	-	-	○	-	○	-	●	●	●	●	●	-	○	○	○	●
C. Meet demands for all uses, including agriculture, urban, and environmental resource needs.	-	●	●	●	●	●	●	-	-	-	●	●	●	●	●	○	-	●	●	-	○	●	●	●	○	●	○	●	-	○
D. Improve coordination of land use and water resources planning.	●	●	-	●	●	○	●	●	●	●	○	●	●	○	●	○	●	-	○	●	○	●	●	●	●	●	○	●	●	●
E. Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure.	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
F. Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible.	-	●	●	●	●	●	●	○	○	○	-	●	-	○	●	○	-	●	-	-	-	-	-	●	○	●	○	●	-	○

	Agricultural Lands Stewardship	Agricultural Water Use Efficiency	Conjunctive Mgmt and Groundwater Storage	Conveyance—Regional/Local	Crop Idling for Water Transfers	Drinking Water Treatment & Distribution	Economic Incentives	Ecosystem Restoration	Flood Management	Forest Management	Groundwater /Aquifer Remediation	Irrigated Land Retirement	Land Use Planning and Management	Matching Water Quality to Use	Municipal Recycled Water	Outreach and Engagement	Pollution Prevention	Rainfed Agriculture	Recharge Area Protection	Salt and Salinity Management	Sediment Management	Surface Storage—CALFED	Surface Storage—Regional/Local	System Reoperation	Urban Stormwater Runoff Management	Urban Water Use Efficiency	Water and Culture	Water Transfers	Water-Dependent Recreation	Watershed Management
G. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	●	-	●	●	-	●	●	●	○	●	●	-	○	●	●	-	●	-	●	●	●	●	●	-	●	-	○	-	●	●
H. Protect, restore, and improve natural resources.	●	-	-	●	-	-	●	●	○	●	●	-	●	-	-	○	○	-	●	●	●	-	-	-	○	-	○	-	○	●
I. Address water-related needs of disadvantaged communities (DACs).	○	○	○	●	○	●	●	○	●	○	●	○	○	●	●	○	●	○	●	○	○	○	○	●	●	○	○	○	●	○
J. Protect and enhance water-associated recreation opportunities.	○	-	-	-	-	-	○	○	-	○	-	-	●	-	-	○	-	-	-	-	○	○	○	-	○	-	○	-	●	●
K. Establish and maintain effective communication among water resource stakeholders in the Region.	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○
L. Enhance public understanding of water management issues and needs.	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○

5.3 Process Used to Consider RMS

The inclusion of RMS in this IRWM Plan is based on a review of all 36 RMS identified by the California Water Plan Update 2013 (DWR, 2013) and the Proposition 1 IRWM Guidelines (DWR, 2016). The RWMG and RAC together determined that 30 RMS are appropriate for inclusion in the Merced IRWM Plan as they are either currently being utilized or may reasonably be utilized in the management of water resources in the Region.

The process of identifying RMS that address the regional goals and objectives identified for the Merced IRWM Plan involved evaluating all strategies in consultation with the RAC. The full list of RMS was reviewed and discussed by the RAC to determine potential of each strategy to meet the Merced Region's IRWM Plan objectives.

5.4 RMS Evaluation for the Merced Region

The following sections describe the relevant RMS in further detail and provide examples of efforts currently underway in the Region that apply each strategy.

5.4.1 Reduce Water Demand

RMS identified in the Reduce Water Demand category include:

- Agricultural Water Use Efficiency
- Urban Water Use Efficiency

These RMS are discussed in further detail below.

Agricultural Water Use Efficiency

Agricultural water use efficiency can reduce the quantity of water used for agricultural irrigation. This strategy could increase the Region's net water savings, improve water quality, provide environmental benefits, and increase energy efficiency.

Strategies recommended by the California Water Plan Update 2013 to achieve agricultural water savings and benefits include:

- Improving irrigation system technology and management of water, both on-farm and at the irrigation district level to minimize water losses.
- Adjusting irrigation schedules to decrease the amount of water applied.
- Installing remote monitoring to allow districts to measure flow, water depth and improve water management and controls.
- Developing community educational conservation activities to foster water use efficiency.

Merced Region Efforts

An example of current agriculture water use efficiency efforts employed by the Region's primary agricultural water supplier (MID) is listed below.

- **MID Water Management Plan and AWMP**. MID has prepared and periodically updates a general Water Management Plan focused on establishing applicable Efficient Water Management Practices, including agricultural water use efficiency and conservation efforts (MID, 2003). In addition, on September 3, 2013, MID prepared and adopted an AWMP to comply with California

SB X7-7. This plan further documents MID's robust conjunctive use activities and commitment to water system efficiency related to agricultural water use. An update to the AWMP was released in July 2016 in order to comply with the Governor's April 2015 Executive Order for a drought management plan (MID, 2016).

- **MID Surface Water/Groundwater Optimization Program**. The purpose of this program, among other objectives, was to increase system efficiency. MID invested several million dollars since the 1989 to complete projects aimed at increasing system efficiency, including water regulating reservoirs, canal automation, remote control monitoring and control through a network of sites under Supervisory Control and Data Acquisition (SCADA), and water order upgrades (MID, 2016).
- **Water Resources Management Plan.** MID has prepared a long-range business plan (the Water Resources Management Plan) that includes, among other things, a long-range infrastructure improvement program focused on modernization of District facilities. The modernization component of the infrastructure plan is focused on improving customer service, system efficiency, and improving water conservation by reducing unnecessary system losses. These types of projects allow for more operational flexibility and the transition to on-demand delivery by allowing tighter control of flows and water levels. Modernization projects include water regulating reservoirs, flow measurement improvements, canal automation, seepage reduction project, and intertie/pumpback facilities. Priority for modernization projects in MID's Capital Improvement Plan was given to major projects that would improve operations and efficiency for large portions of the delivery system, including constructing regulating reservoirs (e.g., Bear Creek Regulating Reservoir, Le Grand and Planada Canal Bifurcation Reservoir, increasing the capacity of El Nido Reservoir, Hadley Lateral Reservoir, Le Grand Reservoir, and Howard Lateral Regulating Reservoir), improving flow measurement and control, and lining portions of the Main and Le Grand Canals. MID has begun work on three of the proposed 12 water regulating reservoirs, as well as several other modernization projects (MID, 2019).

Urban Water Use Efficiency

Due to the Region's growing population and expanding urban development (refer to *Chapter 1, Region Description*), it is vital that urban water use efficiency strategies are adopted to reduce pressure on the Region's groundwater and surface water supplies. Further, in accordance with provisions stipulated by SB x7-7 (the Water Conservation Act of 2009), all urban water suppliers within the Region must reduce urban water consumption by 20% by 2020.

Approaches recommended by the California Water Plan Update 2013 to increase urban water use efficiency include:

- Implementing programs such as Best Management Practices.
- Reviewing the UWMP and taking measures to ensure 20 percent water use reductions are achieved by 2020.
- Installing water efficient landscapes.
- Encouraging gray water and rain water capture to increase water conservation and improve water quality.
- Increasing public outreach and encouraging community involvement.
- Funding incentive programs for small districts and economically disadvantaged communities.

Merced Region Efforts

Various aggressive measures are currently being implemented to increase urban water use efficiency in the Region. One example are the various water demand management measures currently being implemented or planned to be implemented by the City of Merced to increase urban water use efficiency:

- **Residential Plumbing Retrofit:** The City offers low-flow fixtures (including shower heads) and retrofit kits to customers at no cost in order to incentivize water conservation efforts. These kits are available upon request at the City's Finance and Public Works counter. The City also makes these devices available to commercial, industrial, and institutional customers (Carollo, 2017).
- **Water System Audits:** In accordance with California SB 1420 requirements, the City performs water system audits to quantify unaccounted-for water. Agencies are required to submit their audits every five years as part of their UWMP. The water loss volume was estimated by City staff to be approximately eight percent of the City's total water production (Carollo, 2017). However, until the City becomes fully metered, these audit estimates cannot be verified.
- **Metering with Commodity Rates:** The City installs meters for all new connections to allow billing by volume of use.
- **Public Education and Outreach Program:** The City has an active public information program that distributes information to the public through a variety of methods including brochures in its utility bills, press releases via radio and newspaper, school curricula, educational flyers, commercials, webpage videos, and water conservation kit distribution. In addition, the City also hosts a booth to promote water conservation efforts for public events (Carollo, 2017; K. Elwin, personal communication, August 15, 2018).
- **School Education Program:** The City is implementing a school education program that includes providing educational materials and instructional assistance regarding water use efficiency. The school outreach program is specifically geared to the age of the audience from Kinder to College, highlighting conservation best suited to the development level of the audience (K. Elwin, personal communication, August 15, 2018).
- **Water Conservation Coordinator:** The City employs a full time Water Conservation Specialist who serves as the City's Conservation Coordinator. This position is active in the community and is a regular presenter of water conservation at school assemblies and classroom presentations, as well as to community groups like the Chamber of Commerce, League of Women Voters, the Merced Environmental Collective, and the Master Gardeners. In addition, the Conservation Specialist is a regular on the local morning radio talk show, Community Conversations. Finally, the Coordinator hosts a booth to promote water conservation efforts at public events, street fairs, school festivals, and the county fair. At these events, water conservation devices such as hose timers, shower timers, hose nozzles, and leak tablets are given out in addition to brochures and information on saving water (Carollo, 2017; K. Elwin, personal communication, August 15, 2018).
- **Water Waste Prohibition:** In response to the recent drought, the City has ordinances in place to prohibit the waste of water. These include restrictions that reduce water hours and limit the number of days that customers can use water for landscape irrigation purposes. The ordinance levies fines for noncompliance with these restrictions (Carollo, 2017).
- **Planada CSD Water Conservation Project:** The Planada CSD is metering all services within its service area in order to implement volumetric pricing, which is a proven technique to reduce water consumption. Additionally, the District is rehabilitating an aging and brittle portion of the distribution system that is prone to leaks and conveyance system losses. Through these system

improvements, 20% water savings from current usage are estimated to result. This project has received Proposition 84 funding and has been implemented (RMC, 2013c).

5.4.2 Improve Operational Efficiency and Transfers

RMS identified in the Improve Operational Efficiency and Transfers category include:

- Conveyance – Delta
- Conveyance – Regional / Local
- System Reoperation
- Water Transfers

These RMS are discussed in further detail below.

Conveyance - Delta

The Delta conveyance system supplies water to the San Francisco Bay Area, Central Valley, and Southern California. The Merced Region does not currently receive imported water from the Delta.

Delta conveyance strategies identified by the California Water Plan Update 2013 include:

- Establishing performance metrics that record quantity of water deliveries for agricultural and urban users.
- Utilizing Delta Vision Task Force and Bay-Delta Conservation Plan recommendations to increase operational flexibility and conveyance reliability to benefit water supply and aquatic ecosystems.
- Developing strategies that maintain channel capacity in the Delta.

Merced Region Efforts

As the Region does not receive water supplies from the Delta and would not undertake a project involving conveyance within the Delta, the Conveyance-Delta RMS was not included in the MIRWMP.

While Delta conveyance does not have a direct impact on the Region, there is an indirect connection between the Delta conveyance and the Region. Improved conveyance in the Delta can benefit the Region through improved water quality and reduced flooding impacts. The Region currently experiences saline intrusion from the San Joaquin River, and improving fresh water conveyance in the Delta to improve Delta water quality might reduce salinity intrusion into the Region. Additionally, improving flows through the Delta could reduce backwater flooding experienced in the Region.

Although the Region determined that the Conveyance-Delta RMS is not applicable to the MIRWMP, decisions made by the State may require the MIRWMP to consider this RMS in the future. For example, in December 2018, the SWRCB adopted a Final SED on the Proposed Amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. Implementation of the proposed changes would require the Merced Region to release up to 50% of unimpaired Merced River flows, reducing the amount of water available for diversion within the Region. At the SWRCB’s public hearings for the SED process, stakeholders from the Region expressed concerns over the proposed action and noted its impact to the Conjunctive Management and Groundwater Storage RMS, which is important to water supply reliability in the Region.

Conveyance- Regional/Local

As described in detail in Chapter 2 Region Description, the Region relies on both groundwater and surface water supplies. Surface water supplies can be used to offset groundwater demands and to recharge local groundwater basins in certain areas in the Region, and therefore can be used to reduce groundwater overdraft conditions within the Region. As such, the Region would benefit from improvements in water supply reliability and conveyance infrastructure that increase operational efficiency and transfers of surface water and groundwater supplies. Benefits of improving regional/local conveyance infrastructure include: maintaining/increasing water supply reliability, protecting water quality, augmenting current water supplies, and providing water system operational flexibility.

Strategies identified by the California Water Plan Update 2013 for improving regional/local conveyance of water supplies include:

- Improving aging infrastructure, increasing existing capacities, and/or construction of new conveyance facilities.
- Replacing or improving canal structures to improve an irrigation district's ability to manage and control water in the district and reducing spillage.
- Constructing alternative water conveyance pipelines to improve water supply reliability.

Merced Region Efforts

Examples of current regional/local conveyance strategies employed within the Region are listed below.

- **MID's Infrastructure Improvement Program.** As discussed in Section 5.4.1, MID has prepared a long-range business plan (the Water Resources Management Plan) that includes, among other things, a long-range infrastructure improvement program focused on modernization of District facilities. The modernization component of the infrastructure plan is focused on improving customer service, system efficiency, and improving water conservation by reducing unnecessary system losses.
- **MID Efficient Water Management Practices.** MID conducts a variety of water management practices that accomplish improved and more efficient water delivery. These practices include conveyance-related activities such as expanding pipe distribution systems to increase flexibility and capacity and to decrease maintenance and seepage costs.
- **Canal Improvements.** MID canals are used to deliver water supplies, but are also used to receive, convey and discharge stormwater flows. Projects to improve MID canals are regularly adopted to address increasing stormwater discharges that are related to population increase and other factors.

Canal improvement projects include lining canals.

System Reoperation

System reoperation strategies alter operation and management procedures for existing reservoirs and conveyance facilities to increase water-related benefits from these facilities. Changes in water demands and changing climate may require reoperation of existing facilities to increase project yield or address climate change impacts. System reoperation strategies will require making changes to how projects operate to best meet the changing needs of the Region. Some of the potential benefits of system reoperation strategies include: increasing water supply reliability, additional flexibility to respond to extreme hydrologic events, and improving the efficiency of existing water uses.

System reoperation strategies identified by the California Water Plan Update 2013 include:

- Establishing a baseline hydrology and enhanced description of present water management system components.
- Considering possible climate change effects in reoperation projects.
- Collaborating between federal, state, and local agencies on system reoperation studies.

Merced Region Efforts

Examples of Region-wide system reoperation strategy are listed below.

- **Merced Groundwater Subbasin Groundwater Management Plan**. The 2008 MAGPI Groundwater Management Plan, which covers the majority of the Merced Region, establishes a baseline hydrology and a description of water management system components within the Region (AMEC Geomatrix, Inc., 2008).
- **Merced Groundwater Subbasin GSP.** The three GSAs in the Region are collaborating on developing a GSP for the entire Merced Groundwater Subbasin by January 2020. These GSAs include the Merced Irrigation Urban GSA, the Merced Subbasin GSA, and the Turner Island Water

District GSA. The plan will review current groundwater conditions and identify means to ensure the long-term sustainability of the Merced Groundwater Subbasin considering potential future climate change (Merced SGMA, 2018).

- **Lake Yosemite Reoperation.** MID owns and operates Lake Yosemite for water storage and regulating purposes. During the flood seasons, MID releases flows from Lake Yosemite via the Le Grand Canal, one of the two canals that provide a major outlet from the lake (MID, 2016). These flood flows provide beneficial flows in Bear Creek while also increasing flood control capacity in Lake Yosemite.
- **Groundwater Well Reoperation:** MID's groundwater operational strategy is such that only groundwater wells that supply areas of higher elevation are operated during years of ample water supply (defined as the "Base Line Groundwater Pumping"). The change has resulted in the vast majority of MID wells being put on standby during years of adequate water supply and has greatly benefitted groundwater basin recharge deliveries (MID, 2016).

Water Transfers

Water transfers are temporary or long-term changes in the point of diversion, place of use, or purpose of use due to transfer or exchange of water or water rights in response to water scarcity. Benefits to establishing water transfers include improving economic stability and environmental conditions for receiving areas. Compensation for water transfers can fund beneficial projects/activities for the Region, reduce water rates, and/or improve facilities.

Water transfer strategies identified by the California Water Plan Update 2013 include:

- Developing and implementing groundwater management plans and monitoring programs.
- Allowing community participants to identify and respond to conflicts caused by transfers.
- Refining current methods for identifying and quantifying water savings for transfers using crop idling, crop shifting, and water use efficiency measures.
- Improving coordination and cooperation among local, state, and federal agencies to facilitate sustainable transfers.

Merced Region Efforts

The Region has employed various water transfer strategies including the following:

- **Buchanan Dam Water Transfer.** CWD currently coordinates with the USBR to implement a contract that allows CWD to pay to use approximately 24,000 AF of water transferred from Buchanan Dam each year (CWD, 2015).
- **MID Transfers.** Since 1967, MID has implemented numerous water transfers, primarily from Lake McClure and the Merced River. These include sales to DWR, the Environmental Water Account, East Bear Creek Unit, agricultural water users, water users downstream of MID, and certain parcels with riparian entitlements (MID, 2016). Revenue from the sales was used to undertake system improvements and stabilize water rates. Maintaining MID's water rates at a rate lower than the average groundwater pumping cost is important to discourage growers from reverting to groundwater pumping, which impacts the groundwater aquifer and thereby further impacts District revenues.

5.4.3 Increase Water Supply

RMS identified in the Increase Water Supply category include:

- Conjunctive Management and Groundwater Storage
- Desalination
- Precipitation Enhancement
- Recycled Municipal Water
- Surface Storage – CALFED
- Surface Storage – Regional / Local

These RMS are discussed in further detail below.

Conjunctive Management and Groundwater Storage

The reliability of the Region's water supplies can be improved through conjunctive use of both surface and groundwater supplies. Conjunctive management and groundwater storage refers to the coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies to meet water management objectives. The conjunctive management and groundwater storage strategy seeks to increase water supply reliability and groundwater sustainability. Several benefits of utilizing conjunctive management and groundwater storage strategies include: improving water supply reliability and sustainability, reducing groundwater overdraft and land subsidence, protecting water quality, and improving environmental conditions.

Conjunctive management and groundwater storage strategies identified by the California Water Plan Update 2013 include:

- Implementing monitoring, assessment, and maintenance of baseline groundwater levels.
- Encouraging local water management agencies to coordinate with tribes and other agencies involved in activities that might affect long term sustainability of water supply and water quality.
- Local groundwater monitoring and management activities and feasibility studies to increase the coordinated use of groundwater and surface water.

Merced Region Efforts

Conjunctive management and groundwater storage strategies being considered within the Region are listed below.

- **MID Conjunctive Use Program**. MID has been implementing an extensive conjunctive use program since the 1950s. This program reached its maximum capacity in the late 1960s. MID owns and operates approximately 220 active conjunctive groundwater wells; these wells typically remain on standby and are used only when and where there is a shortage of surface water. Baseline MID groundwater pumping has been as low as 4,100 AF during wet years when groundwater is used solely to supply areas of high elevation that are not connected to a surface water system (MID, 2016). In dry years, MID's well field can produce up to 80,000 AF of conjunctive groundwater supplies. Through its conjunctive management program, MID has expanded its groundwater recharge during years of ample surface water to a total of 45,000 AF as follows:

  1. Reoperation of Groundwater Wells: See 5.4.2 Improve Operational Efficiency and Transfers, System Reoperation.

2. Low Head Boosters: These boosters were constructed to serve high elevation areas with surface water rather than groundwater wells in years of ample surface water supply. Groundwater wells that serve these areas remain on standby to be used in dry years (MID, 2016).
3. Highlands Pilot Project: In 1996, MID constructed a pond and installed a pumping system to provide filtered, pressurized water service to 450 acres, replacing the use of private groundwater wells in normal years (MID, 2016). During dry years, the MID supplies groundwater to the area.
4. MID Groundwater Conservation Incentive Program: MID assists growers using private groundwater wells to return to surface water by providing a monetary incentive which is paid back through a commitment to purchase surface water during years of ample water supply (MID, 2016).

- **Merced Groundwater Basin Groundwater Management Plan**. Since its formation, the primary focus of MAGPI has been the implementation of the Merced Groundwater Basin Groundwater Management Plan, which promotes conjunctive surface water and groundwater management (Amec Geomatrix, 2008). As such, the fifteen municipal and agricultural water purveyors that comprise MAGPI work together on activities aimed at improving long term sustainability of the Merced Groundwater Subbasin.
- **Merced Groundwater Subbasin GSP.** The three GSAs in the Region (Merced Irrigation – Urban GSA, the Merced Subbasin GSA, and the Turner Island Water Distract GSA) are collaborating on developing a GSP for the entire Merced Groundwater Subbasin by January 2020. The plan will review current groundwater conditions, evaluate climate change impacts on the groundwater basin, and identify means to ensure the long-term sustainability of the Merced Groundwater Subbasin (Merced SGMA, 2018).
- **MAGPI and DWR Memorandum of Understanding**. In 2001, MAGPI entered into an MOU with DWR to work cooperatively to promote conjunctive use projects within the Merced Subbasin.
- **Groundwater Recharge Feasibility Study**. As part of the IRWM program, the Region completed a Groundwater Recharge Feasibility Study in 2013 (RMC, 2013a). The purpose of this study was to define areas with high potential for recharge.
- **El Nido Area Recharge Project**. One of the areas identified through the Groundwater Recharge Feasibility Study as having high potential for recharge is the El Nido area. MID has received Proposition 84 funding and has implemented a project to maximize the use of an existing water license from the SWRCB to divert water from Mariposa Creek for recharge in the El Nido area. The project automates the existing diversion structure on Mariposa Creek, allowing MID to increase use of the existing surface water rights. A combination of direct and in-lieu recharge will be implemented, using an existing recharge basin in El Nido, as well as adjacent agricultural lands for recharge (RMC, 2013c).
- **Pilot Study of Off-Season Flooding of Agricultural Lands**. California Water Foundation worked with MID to publish a pilot feasibility study in 2015 to determine the effectiveness of using winter-time excess flows to flood agricultural lands for groundwater recharge in the San Joaquin Valley (RMC, 2015).

Desalination (Brackish and Sea Water)

Desalination, the process of removing salts and other minerals from saline water, requires complicated technologies and is an energy intensive technology. Desalination offers many potential benefits including:

increasing water supply reliability during drought periods, reducing dependence on groundwater supplies, protecting public health, and facilitating water recycling and reuse.

Recommendations identified by the California Water Plan Update 2013 to facilitate desalination strategies include:

- Desalination projects should be given the same funding opportunities as other water supply and reliability projects.
- Ensure most economical and environmentally appropriate desalination technology is utilized.
- Project sponsors need to ensure planning of desalination projects is a collaborative process that engages key stakeholders, the general public, and permitting agencies.

Merced Region Efforts

Desalination is not currently used within the Region. Due to the distance between the Merced Region and potential saline water sources, desalination is not likely to serve as a future water source for the Region and was not considered in the IRWM Plan. There is a saline water sink along the San Joaquin River, but this area is not considered a viable water source because extensive groundwater pumping in this area could cause subsidence or loss of interconnected surface waters.

Precipitation Enhancement

Precipitation enhancement strategies seek to artificially stimulate clouds to produce more rainfall or snowfall than would naturally occur. The benefit of this strategy is primarily to increase water supply.

Recommendations identified by the California Water Plan Update 2013 for implementing precipitation enhancement projects include:

- Seeking State support for development and funding of new precipitation enhancement projects.
- Collecting data and evaluations of existing California precipitation enhancement projects to perform research on the effectiveness of the technology.
- Investigating the potential of augmenting Colorado River Water supply through cloud seeding.

Merced Region Efforts

Precipitation enhancement is not currently implemented within the Region. Although the Region relies on surface water from the Merced River, which varies depending upon rainfall patterns, precipitation enhancement is not a likely RMS for the Region due to its expense and uncertain effectiveness. Furthermore, current regulations in Yosemite National Park prevent precipitation enhancement from being utilized in the Region.

Municipal Recycled Water

One way to offset current and future water demands for the Region is to reuse highly treated wastewater for non-potable uses (recycled municipal water). Recycled water use can be a potentially significant local resource that can be used to help reduce groundwater and surface water demands. Further, because recycled water supplies are minimally impacted by changes in hydrology, they are not expected to be significantly impacted by climate change and are considered a drought-proof supply.

Recycled municipal water strategies identified by the California Water Plan Update 2013 and Water Recycling 2030: Recommendations of California's Recycled Water Task Force (DWR, 2003) include:

- Increasing funding availability for water reuse/recycling facilities and infrastructure.

- Creating education curriculum for public schools and institutions of higher learning to educate the public about recycled water.
- Engaging the public in an active dialogue and encouraging participation in the planning process of water recycling projects including non-potable and potable applications.
- Providing resources (i.e. funding) to agencies that will perform comprehensive analysis of existing water recycling projects to estimate costs, benefits, and water deliveries.
- Assessing water recycling technology to determine least costly and environmentally appropriate technology based on location and need.

Merced Region Efforts

Examples of water recycling strategies employed within the Region are described below.

- **Water Reclamation Plants.** The Cities of Merced and Atwater both have water reclamation plants that treat and reuse wastewater. The City of Merced's water reclamation plant is capable of producing recycled water in accordance with Title 22 of the California Code of Regulations for irrigation and industrial uses. Although the City of Merced currently does not have the infrastructure to convey large volumes of recycled water, recycled water is utilized within the Public Works Collections Department, as well as for agricultural irrigation and environmental purposes (Carollo, 2017).

Surface Storage- CALFED

Potential benefits from CALFED surface storage include releases of new storage and system flexibility such that the operation of other facilities can be modified without reducing current benefits. The additional water storage can be used to improve ecosystem functions, conditions for target species, water quality, and supply reliability for water users.

CALFED surface storage strategies identified by the California Water Plan Update 2013 include:

- Decreasing demand of imported water through water conservation programs.
- Engaging stakeholders, potential project participants, tribes, the public, and agencies in identifying, evaluating, and quantifying potential projects that address the CALFED surface storage goals and their effects (positive and negative).
- Developing alternatives and potential future scenarios that incorporate alternative Delta conveyance, operations, and possible climate change effects to allow potential participants to assess their interest in specific projects.
- Developing mechanisms that provide assurance that projects are being operated in a manner consistent with the objectives of CALFED surface storage.

Merced Region Efforts

The Merced Region does not currently benefit from surface storage projects related to the Delta and does not use imported water. However, CALFED did identify potential surface storage projects within the Merced Region that are of interest to the Region.

On March 31, 1997, CALFED produced a preliminary study in support of a 101-foot high offstream dam on Dry Creek with a 240,000 AF capacity. The proposed project, known as the Montgomery Dam, could be reevaluated in future updates to the MIRWMP for use as a flood control reservoir receiving flows from the Merced River. Such a project would result in higher storage behind New Exchequer Dam with a revised higher Top of Conservation pool. Benefits of the increased storage could include a more reliable water supply, preservation of the cool water pool benefitting fisheries, support of wetlands at the minimum pool level and potential venues for recreation. The more reliable water supply and preservation of the cool water pool provide an important benefit in the face of climate change.

Surface Storage- Regional/Local

Though groundwater is the predominant supply used in the Merced Region, the Region also uses surface water from MID as well as a system of canals, reservoirs, and dams for conveyance and storage of surface water supplies. Projects that incorporate regional/local surface water storage focus on alternatives to expand local surface storage capacity. Climate change threatens to change the timing of precipitation, with fewer, more intense rainfall events. Increased surface storage can provide flood management benefits, as well as improving the Region’s ability to capture and store watershed runoff under changing climate conditions. Benefits of expanding regional/local surface storage include: improved flood management, ecosystem management, emergency water supply, river and lake recreation, capture of surface water runoff, and water supply reliability against catastrophic events and droughts.

Regional/local surface storage strategies identified by the California Water Plan Update 2013 include:

- Development of a comprehensive methodology for analyzing project benefits and costs by local agencies.
- Continued studies, research, and dialogue to identify a common set of tools for determining costs and benefits of surface storage projects.
- Adaptively manage operations of existing surface storage facilities.
- Rehabilitation and/or enlargement of existing surface storage infrastructure.
- Developing water purchasing agreements to buy water from other agencies that own storage reservoirs with substantial water supplies.

Merced Region Efforts

Examples of regional/local surface storage strategy considered within the Region are listed below.

- **Increasing Carryover Storage**: As part of its effort to increase surface water storage, MID is pursuing increasing carryover storage in New Exchequer Reservoir. This will be accomplished by raising the current New Exchequer spillway elevation by about 8 feet (MID, 2016).
- **Potential Addition of Local Surface Storage**: Developing a project to provide additional local surface water 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 to 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 (MID, 2016).
- **Conjunctive Management**. Conjunctive management is a key resource management strategy in the Region, and is linked to surface storage. Conjunctive management is highly dependent on how well surface water and groundwater are managed as a single source to adapt to the climate system. 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 water, flood flows, runoff, recycled water, and/or desalinated water for dry seasons in groundwater basins (MID, 2016).

5.4.4 Improve Water Quality

RMS identified in the Improve Water Quality category include:

- Drinking Water Treatment and Distribution
- Groundwater Remediation/Aquifer Remediation
- Matching Quality to Use
- Pollution Prevention
- Salt and Salinity Management
- Urban Runoff Management

These RMS are discussed in further detail below.

Drinking Water Treatment and Distribution

Providing a reliable supply of safe drinking water is critical for protecting public health. Though the Region's water purveyors provide high-quality drinking water that meets regulatory standards, public water systems must continue developing and maintaining adequate water treatment and distribution facilities to ensure that public health is protected. Climate change could reduce flows in the Merced River and increase saline intrusion in groundwater supplies, impacting the quality of existing supplies and increasing the level of treatment needed to provide drinking water that meets all regulatory requirements. Several benefits of drinking water treatment and distribution strategies include: improving public health, reducing water distribution delivery problems, and ensuring delivery of high-quality drinking water.

Drinking water treatment and distribution strategies identified by the California Water Plan Update 2013 include:

- Working closely with California Department of Public Health (CDPH) to quantify the total needs for water system infrastructure improvement and replacement.
- Regionalizing and consolidating public water systems.
- Developing incentives to allow water systems to reduce waste of limited water resources.
- Researching and developing new treatment technologies.
- Providing additional funding for water supply, water treatment, and infrastructure projects to ensure safe and reliable supply of drinking water for individuals and communities.
- Joining the California Water/Wastewater Agency Response Network program, which provides mutual aid and assistance more quickly than through the Standardized Emergency Management System (SEMS).
- Creating source control and reduction programs to address pharmaceuticals and personal care products.

Merced Region Efforts

Drinking water treatment and distribution strategies employed within the Region are listed below.

- **Drinking Water Systems**. All of the water purveyors that provide drinking water have water systems that provide water to the Region's residents. Domestic water suppliers in the Region are discussed in Chapter 2 Region Description, Section 2.3.3.

- **Monitoring**. Water purveyors in the Merced Region monitor drinking water regularly according to state (CDPH) and federal (USEPA) regulations.

Groundwater Remediation/Aquifer Remediation

Groundwater is a valuable local resource that is comprehensively managed through MAGPI's adopted Groundwater Management Plan. Groundwater Remediation/Aquifer Remediation strategies seek to improve the quality of degraded groundwater for beneficial uses. Groundwater contamination can come from a multitude of sources such as: heavy metals, salts, organic and inorganic pollutants, nitrates, arsenic, pesticides, septic systems, and urban and agricultural activities. Several benefits of adopting groundwater remediation/aquifer remediation strategies include: availability of additional water supplies, avoiding purchasing alternate water supplies, and storage of excess surface water supplies in remediated aquifers.

Groundwater remediation/aquifer remediation strategies identified by the California Water Plan Update 2013 include:

- Limiting potentially contaminating activities in recharge areas.
- Identifying historic commercial and industrial sites with contaminated discharges and responsible parties to remediate sites.
- Implementing source water protection measures.
- Establishing and supporting funding for detecting emerging contaminants by commercial laboratories and installation of wellhead treatment systems.

Merced Region Efforts

Groundwater remediation strategies employed within the Region are listed below.

- **Castle Airport Aviation Groundwater Remediation**. Castle Airport, a former military base located outside of the City of Merced, has known plumes of TCE. This site is undergoing remediation, including implementation of groundwater extraction systems that are being used to remove TCE from the groundwater. As of 2007, 13.6 billion gallons of contaminated groundwater was extracted and treated near or within the Castle Airport remediation site (AMEC Geomatrix, Inc., 2008).
- **Detection of Emerging Contaminants**. In 2007, research was completed by the University of California, Davis and USGS, which involved surveying for pharmaceuticals in dairies located within the Merced Subbasin. This research resulted in a few detections of pharmaceuticals in shallow groundwater areas within the Merced Subbasin (Carollo, 2017).

Matching Water Quality to Use

Matching water quality to use is directly linked to four other RMS: pollution prevention, recycled municipal water, salt and salinity management, and groundwater/aquifer remediation. Matching quality to use strategies recognize that water quality should suitably match its intended use such that water quality constituents do not adversely affect the intended use of water. Several benefits of maintaining and matching water quality to use include: reduction of disinfection byproducts in delivered drinking water sources, opportunities for blending water sources through improvements in treated water quality, potential to reduce energy use due to reduced quality needs and avoiding costly treatment procedures.

Strategies for matching water quality to use identified by the California Water Plan Update 2013 include:

- Managing water supplies to optimize and match water quality to the highest possible use and to the appropriate technology.
- Encouraging upstream users to minimize the impacts of non-point urban and agricultural runoff and treated wastewater discharges.
- Supporting the development of salt management plans.
- Reviewing projects to determine the potential impacts from wastewater elimination into local streams.
- Supporting research into solutions to the potential conflicts between ecosystem restoration projects and the quality of water for drinking water purposes.

Merced Region Efforts

Projects and programs that match quality to use in the Merced Region are listed below.

- **Merced Salinity and Nutrients in Groundwater & Surface Waters Study**. Through the IRWM program, stakeholders in the Merced Region developed a salinity and nutrient management study in 2013 (RMC, 2013b) which identifies water quality issues in the Region and provide a basis for managing salinity and nutrients in the Merced Region.
- **Uses of Non-Potable Water.** Two municipalities within the Region, the City of Merced and the City of Atwater, currently supply treated wastewater to agricultural users and to wildlife management wetlands. This allows water reuse to occur without the additional treatment that may be required if this water were to be reused for other purposes. The City of Merced also uses recycled water within its Public Works Collections Department. Overall, in 2015, the City of Merced used 4,886 AF for sewer and storm drain flushing, agricultural, and environmental purposes (Carollo, 2017).

Pollution Prevention

Pollution prevention strategies are vital for protecting and improving water quality at its source, and for preventing costly water treatment options. Preventing pollution throughout watersheds ensures that water supplies can be used and reused for a broad number of uses.

Pollution prevention strategies identified by the California Water Plan Update 2013 include:

- Developing proper land management practices that prevent sediment and pollutants from entering source waters.
- Establishing drinking water source and wellhead protection programs to protect drinking water sources and groundwater recharge areas from contamination.
- Identifying communities relying on groundwater contaminated by anthropogenic sources for drinking water and take appropriate regulatory action.
- Addressing improperly destroyed, sealed and abandoned wells that can serve as potential pathways for groundwater contaminants.

Merced Region Efforts

Examples of current pollution prevention strategies employed within the Region are listed below.

- **Merced Stormwater Management Program.** The City of Atwater, the City of Merced, the County of Merced, and MID are co-permittees (the Merced Stormwater Group) jointly implementing a regional Stormwater Management Program that covers the majority of the Region.

The Merced Stormwater Group's Stormwater Management Program addresses priority pollutants that are common in stormwater runoff from municipal areas, and therefore works to prevent pollution within the Region. In June 2015, the Merced Stormwater Program issued its *Program Effectiveness Assessment and Improvement Plan* in order to meet requirements for the Phase II Small Municipal Separate Storm Sewer System (MS4) General Permit (WGR Southwest, Inc., 2015). In addition, the Region is currently in the process of developing a Storm Water Resource Plan, which is an integrated plan that will focus on regional watershed-based stormwater priorities.

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 quality, 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 2013 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 action.
- Reviewing existing policies to address salt management needs and ensure consistency with long-term sustainability.
- Collaborating with other interest groups to optimize resources and effectiveness.
- Identifying environmentally acceptable and economically feasible methods for closing the loop on salt.

Merced Region Efforts

An example of a current salt and salinity management strategy employed by the Region is listed below.

- **Merced Salinity and Nutrients in Groundwater & Surface Waters Study**. Through the IRWM program, stakeholders in the Merced Region developed a salinity and nutrient management study in 2013, which identifies water quality issues in the Region and provide a basis for managing salinity and nutrients in the Merced Region (RMC, 2013b).
- **Reducing Encroachment of Saline Water Wedge**. MID provides water supply within its sphere of influence including areas south of Livingston during years of ample surface supply. The surface water replaces groundwater pumping in areas near the periphery and up-gradient of a high salinity wedge.

Urban Stormwater Runoff Management

Urban runoff management strategies involve managing both stormwater and dry weather runoff. To successfully manage urban runoff, agencies need to incorporate other resource management strategies such as pollution prevention, land use planning and management, watershed management, urban water use efficiency, recycled municipal water, recharge area protection, and conjunctive management. Several potential benefits of urban runoff management strategies include: minimizing soil erosion and sedimentation problems, reducing surface water pollution, protecting natural resources, protecting and augmenting groundwater supplies, and improving flood protection.

Urban runoff management strategies identified by the California Water Plan Update 2013 include:

- Coordinating efforts with agencies, stakeholders, and the public to decide how urban runoff management should be integrated into work plans.
- Encouraging public outreach and education concerning funding and implementation of urban runoff measures.
- Designing recharge basins to minimize physical, chemical, or biological clogging.
- Working with community to identify opportunities to address urban runoff management.
- Providing incentives for the installation of low impact development features on new and existing developments.
- Emphasizing source control measures and strong public education/outreach efforts as being the most effective way to manage urban runoff in this highly arid region.

Merced Region Efforts

An example of a current urban runoff management strategy employed by the Region is listed below.

- **Merced Stormwater Management Program.** The City of Atwater, the City of Merced, the County of Merced, and MID are co-permittees (the Merced Stormwater Group) that jointly implement a regional Stormwater Management Program covering the majority of the Region. The Merced Stormwater Group's Stormwater Management Program addresses priority pollutants that are common in stormwater runoff from municipal areas and emphasizes implementing urban runoff management strategies. In June 2015, the Merced Stormwater Program issued its *Program Effectiveness Assessment and Improvement Plan* in order to meet requirements for the Phase II Small MS4 General Permit (WGR Southwest, Inc., 2015). In addition, the Region is currently in the process of developing a Storm Water Resource Plan, which is an integrated plan that will focus on regional watershed-based stormwater priorities and the identification of stormwater and dry weather runoff projects to be implemented in the future.

5.4.5 Improve Flood Management

The RMS identified in the Improve Flood Management category is:

- Flood Risk Management

This RMS is discussed in further detail below.

Flood Management

The Merced Region is subject to flooding, and many portions of the Region are located within the 100-year flood zone as defined by FEMA (refer to Chapter 2, Region Description for more information). Reducing flood risks will require management strategies that enhance flood protection through projects and programs that assist in managing flood flows and to prepare for, respond to, and recover from floods.

Flood risk management strategies identified by the California Water Plan Update 2013 include:

- Structural approaches that can consist of:
    - Setting back levees

- Modifying channels to include lining (i.e. concrete, rip rap) to improve conveyance of flood flows
    - High flow diversions into adjacent lands to temporarily store flows
    - Improved coordination of flood operations
    - Maintaining facilities to secure the long-term preservation of flood management facilities
- Land use management approaches that consist of:
    - Floodplain function restoration to preserve and/or restore the natural ability of undeveloped floodplains to absorb, hold, and release floodwaters
    - Floodplain regulation
    - Development and redevelopment policies
    - Housing and building codes
- Disaster Preparedness, Response, and Recovery for flood risk management approaches such as:
    - Information and education
    - Disaster preparedness
    - Post-flood recovery

Merced Region Efforts

Examples of flood risk management strategies considered by the Region are listed below.

- **Merced Region Integrated Flood Management Summary**. In conjunction with preparation of the 2013 IRWM Plan, the Region completed an *Integrated Flood Management Summary* to improve integrated flood management in the Region (RMC, 2013a). This effort summarized opportunities to coordinate and integrate Merced IRWM flood management planning with progress made by the Central Valley Flood Management planning process.
- **Black Rascal Flood Control Project**. The Black Rascal Flood Control Project protects DACs in the Merced Region from chronic flooding issues that have plagued the Region for decades. The project, which has now received Proposition 84 funding and is currently being implemented, evaluates various detention basin alternatives along Black Rascal Creek to protect downstream communities from a 200-year flood event, which is the standard level of flood protection for urban development (RMC, 2013c). Construction of this project is anticipated to begin in the year 2021 and continue through 2022.
- **Flood Water Conveyance Projects.** A number of projects have been proposed to divert flows from watersheds that experience high flood flows to watersheds that could benefit from additional water for environmental enhancements, water supply or groundwater recharge.

5.4.6 Practice Resources Stewardship

RMS identified in the Practice Resources Stewardship category include:

- Agricultural Lands Stewardship
- Ecosystem Restoration
- Forest Management
- Land Use Planning and Management
- Recharge Area Protection
- Sediment Management
- Watershed Management

These RMS are discussed in further detail below.

Agricultural Lands Stewardship

Agricultural lands stewardship is the practice of conserving and improving land for various conservation purposes, as well as protecting open spaces and rural communities. Several potential benefits of agricultural lands stewardship management strategies include: protecting environmentally sensitive lands, recharging groundwater, improving water quality, providing water for wetland protection and restoration, increasing carbon sequestration within soil, and reducing costs of flood management.

Agricultural land stewardship strategies identified by the California Water Plan Update 2013 include:

- Stabilizing stream banks to slow bank erosion and filter drainage water from the fields.
- Installing windbreaks (i.e. trees and/or shrubs) along field boundaries to help control soil erosion, conserve soil moisture, improve crop protection among many other benefits.
- Performing conservation tillage to increase water infiltration and soil water conservation and reduce erosion and water runoff.
- Encouraging irrigation tailwater recovery to help capture and reuse irrigation runoff water to benefit water conservation and off-site water quality.

Merced Region Efforts

An example of a current agricultural lands stewardship management strategy employed by the Region is listed below.

- **UC Merced Agricultural Conservation Courses**. UC Merced currently offers courses regarding conservation and other sustainable agricultural techniques. The content of these courses vary but may include topics such as education regarding soil erosion and conservation tillage.
- **El Nido Area Recharge Project.** MID has implemented a project to maximize the use of an existing water license from the SWRCB to divert water from Mariposa Creek for recharge in the El Nido area. MID has obtained letters of interest from individuals that own or lease agricultural lands in the El Nido indicating their intent to spread flood flows from Mariposa Creek on their lands, thereby allowing the agricultural lands to act as intermittent recharge basins (RMC, 2013c).

Ecosystem Restoration

Ecosystem restoration strategies are vital for improving modified natural landscapes and biological communities. Restoration of aquatic, riparian, and floodplain ecosystems are of primary concern, as they are most directly affected by water and flood management actions and likeliest to be affected by climate change. Potential benefits of establishing ecosystem restoration strategies include: improved water quality and quantity for wildlife, aquatic species, and human consumption; and increased diversity of native species and biological communities.

Ecosystem restoration strategies identified by the California Water Plan Update 2013 include:

- Increasing the use of setback levees and floodwater bypasses.
- Creating programs that support and fund the identification of stream flow needs.
- Establishing biological reserve areas that connect or reconnect habitat patches.
- Expanding riparian habitat.
- Devising climate change adaptation plans that benefit ecosystems, water, and flood management.
- Reproducing natural flows in streams and rivers.

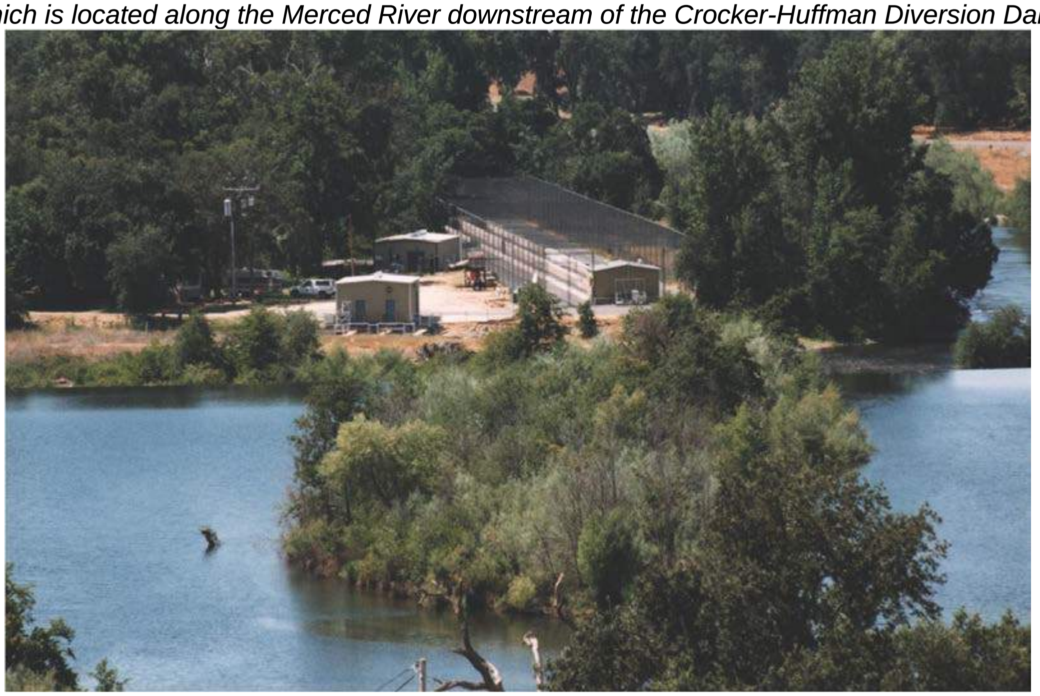
- Controlling non-native invasive plant and animal species.
- Filtering of pollutants and recharging aquifers.

Merced Region Efforts

Examples of current ecosystem restoration strategies employed by the Region are listed below.

- **Environmental Water Provisions.** The Region has a growing environmental water demand, and MID and other water purveyors regularly release water to augment natural flows in streams and rivers. For example, MID has benefitted fisheries and ecosystems through water flow releases down the Merced River to the Merced National Wildlife Refuge and to the East Bear Creek Unit (MID, 2016).
- **October Pulse Flow:** Since 1999, MID has coordinated with California Fish and Wildlife for the release of a water pulse flow designed to attract adult Chinook Salmon. This flow equates to 12,500 AF during the month of October (MID, 2016).
- **Lower Merced River Stewardship Project.** Ecosystem restoration is one of the various strategies employed by the East Merced Resource Conservation District's Lower Merced River Stewardship Project. A key component of the project was updating maps of invasive species along the lower Merced River and subsequent removal of species such as water hyacinth, Arundo and star thistle. Planting of a restoration area is still in progress.

MID's October pulse flows help to attract fall Chinook Salmon to the Merced River Salmon Hatchery, which is located along the Merced River downstream of the Crocker-Huffman Diversion Dam.



Forest Management

Forest management strategies focus on activities that are designed to improve the availability and quality of water for downstream users on both publicly- and privately-owned forest lands. Water produced by forest has an economic value that equals or exceeds that of any other forest resource (DWR, 2013). Several potential benefits of establishing forest management strategies include: interception of rainfall, reduction of urban runoff, energy-efficient shade during hot weather, reduce flooding and increase dry-season base flows, and protection from surface erosion and filtering pollutants.

Several forest management strategies identified by the California Water Plan Update 2013 include:

- Establishing long-term monitoring to understand hydrologic changes resulting from possible climate change effects through the installation of stream gages, precipitation stations, water-quality and sediment monitoring stations, and long-term monitoring wells.
- Increasing research efforts into identifying effective BMPs for forest management and the effects of wildfires.
- Assessing sediment sources and erosion processes in managed and unmanaged forested watersheds.
- Increasing multi-party coordination of forest management.
- Improving communication between downstream and upstream water users.
- Developing public education campaigns for water users.

Merced Region Efforts

Although the local water agencies that constitute the RWMG currently have no responsibility to manage the upland forested areas that drain to the Region, protection of those headlands is important for ensuring high quality surface runoff supplies. Additionally, forest management is an important component of increasing water supply.

An example of a forest management strategy employed by the Region is listed below.

- **Sierra Nevada Adaptive Management Project (SNAMP).** SNAMP was a joint effort by the University of California, state and federal agencies, and the public to study the predicted and actual effects of management of forest lands in the Sierra Nevada across four response variables: public participation, wildlife, water and fire/forest health. In the upper Merced River watershed, SNAMP researched water quality and quantity across treatment and control catchments prior to and after vegetation treatments. The SNAMP project was completed in 2015, with the Final SNAMP Report and response from MOU Partners published in 2016 (UC Science Team, 2016).

Land Use Planning and Management

Land use planning and management is aimed at developing more efficient and effective land use patterns, recognizing that land use type and intensity influence water supply, water quality, flood management and natural habitat. Integrating land use and water management involves planning for housing and economic development needs while providing for resource protection.

Land use planning and management strategies identified by the California Water Plan Update 2013 include:

- Regulating land use through zoning and subdivision regulations.
- Providing incentives for developers to plan and build infill developments and more compact, mixed-use urban developments.
- Controlling stormwater through low impact development.
- Adopting green building codes with low impact development principles.

Merced Region Efforts

An example of a land use planning and management strategy employed by the Region is listed below.

- **Merced County Zoning Code.** The County's zoning code discourages development in flood zones and requires construction of individual stormwater detention basins for new development to limit peak flows to pre-project conditions (Merced County, 2016).

Recharge Area Protection

Recharge areas provide the primary means of replenishing groundwater. Strategies to protect recharge areas ensure the continual capability for the area to recharge groundwater. Protecting recharge areas requires the implementation of urban runoff management strategies, groundwater remediation strategies, and conjunctive management strategies. Several potential benefits of establishing recharge area protection strategies include: protecting and maintaining high-quality groundwater, increased amount of groundwater storage, reduction of urban runoff, and some removal of microbes and chemicals through percolation.

Recharge area protection strategies identified by the California Water Plan Update 2013 include:

- Expanding research into surface spreading and the fate of chemicals and microbes in recharge water.
- Increasing funding for the identification and protection of recharge areas.
- Creating education and media campaigns to increase public awareness and knowledge on the importance of recharge areas and relevancy to groundwater.
- Requiring source water protection plans.
- Developing methods for analyzing the economic benefits and costs of recharge areas.

Merced Region Efforts

Examples of current recharge area protection strategies employed by the Region are listed below.

- **Cressey Recharge Basin Project.** After the successful completion of its associated pilot project (which was demonstrated to recharge 2.6 AF/acre/day), MID began operating the existing Cressey Recharge Basin in 2011. The second phase of the project, which received Proposition 84 funding and has been implemented, expands the existing recharge basin from 8 acres to 13 acres (RMC, 2014).

- **El Nido Recharge Basin.** MID has an 18-acre recharge basin in El Nido area. MID has received Proposition 84 funding and has implemented a project to establish effective recharge rates and other complete improvements to optimize diversions from Mariposa Creek to the basin (RMC, 2013c).

The photos below show the Cressey Basin Direct Recharge Project at start-up and in operation.

The El Nido Recharge Basin project includes automation of the existing manually operated El Nido Dam to optimize diversions from Mariposa Creek for recharge in the El Nido Area.

Sediment Management

Sediment is a valuable natural resource that is a critical component of a healthy watershed and environment. The impacts of proper sediment management are all-encompassing, involving elements like coastal safety, river basins and waterways, and the local economy. Sediment management includes addressing excessive sediment in some cases, while increasing the quantity of sediment in other cases. For example, undesirable sediment (such as post-disaster debris) can reduce the hydraulic capacity of stream and flood channels, which can greatly increase the risk of damage in flood events. Meanwhile, positive uses for sediment include the restoration of coastal habitats such as wetlands and beaches.

Sediment management strategies identified by the California Water Plan Update 2013 include:

- Supporting beneficial use of sediments that must be dredged for navigation waterways and flood control channels.
- Using remote sensing as a tool for sediment transport management.
- Developing sediment and flow monitoring programs to increase data about sediment yields, which will inform extraction management and dredging budgets.
- Developing models for sediment dynamics in estuarine and near-shore environments in order to understand sediment transport issues when it comes to climate adaptation efforts.

Merced Region Efforts

An example of a sediment management strategy employed by the Region is listed below.

- Stormwater BMPs are required at construction sites in order to reduce pollutant discharges, including sediment. Merced County and municipalities within the Region enforce these practices in accordance with applicable NPDES discharge permits.
- Future sediment management in the Region may be informed by the *Sediment Management Investigation* project included in the Mid-San Joaquin River Flood Management Plan (ESA, 2014). This project would include data collection and analysis in order to develop an approximate sediment budget and a conceptual model of sediment transport dynamics for the San Joaquin River between the Merced River and the Stanislaus River.

Watershed Management

Watershed management strategies increase and sustain a watershed's ability to provide for the diverse needs of the communities that depend on it. Managing at the watershed scale has proven effective in coordinating and integrating the management of numerous physical, chemical, and biological processes. Watershed management provides a basis for greater integration and collaboration among those policies and actions.

Watershed management strategies identified by the California Water Plan Update 2013 include:

- Creating a scientifically-valid tracking and reporting method to document changes in the watershed.
- Assessing the performance of projects and programs.
- Providing watershed information to better inform local land use decision makers on how to maintain and improve watershed functions.
- Using watershed approaches in which all RMS strategies are coordinated.

Merced Region Efforts

Examples of watershed management strategies employed by the Region are listed below.

- **Merced River Alliance Project**. The Merced River Alliance was formed to establish and promote a river-wide, watershed-scale view of the Merced River to engage stakeholders in a collaborative effort to work together to protect this valuable resource. The *Merced River Alliance Project Final Report* focuses on assessing and evaluating the Merced River at the watershed-scale (Stillwater Sciences, 2008a and 2008b).
- **Merced River Education and Enhancement Program.** This program integrates a series of small, related initiatives to provide holistic, watershed-based benefits to the Merced River watershed. It includes strong community awareness and education component. It also includes monitoring to

document changing conditions in the upper Merced River watershed related to climate change and research into improved methods of communicating climate change risks to the general public (RMC, 2013c). This project received Proposition 84 funding and has been implemented.

5.4.7 People and Water

RMS identified in the People and Water category include:

- Economic Incentives (Loans, Grants and Water Pricing)
- Outreach and Engagement
- Water and Culture
- Water-Dependent Recreation

These RMS are discussed in further detail below.

Economic Incentives (Loans, Grants and Water Pricing)

Economic incentives can influence water management, amount and timing of water use, wastewater volume, and source of supply. Types of incentives include low interest loans, grants, and water rates and rate structures. Free services, rebates, and use of tax revenues to partially fund water services have a direct effect on the prices paid by water users. Several potential benefits of establishing or improving economic incentive-based strategies include: promoting efficient water management practices and encouraging the adoption/improvement of water efficient/ on-site water recycling technologies.

Economic incentive management strategies identified by the California Water Plan Update 2013 include:

- Instituting loans and grant programs that support better regional water management.
- Adopting policies that promote long-term water use efficiency.
- Developing modeling tools for economic analyses of economic incentives as well as guidelines and ranking criteria for grant and loan awards.
- Exploring innovative financial incentives.

Merced Region Efforts

Example economic incentive strategies employed by the Region are listed below.

- **MID Incentives**. MID implements several efficient water management practices, such as the Merced Groundwater Conservation Incentive Program and an incentive pricing structure that include economic incentives to promote water use efficiency (MID, 2016).
- **City of Merced Water Use Efficiency.** The City of Merced implements several demand management measures that aim to promote long-term water use efficiency, including: water waste prohibition ordinances and metering with commodity rates that allow for billing to occur by volume of use (Carollo, 2017).

Outreach and Engagement

Outreach and engagement are critical to facilitating public contributions and inclusion in water infrastructure planning. Relying on technical expertise alone to spearhead water management systems can result in unintended environmental and social consequences, such as social injustice issues and degraded ecosystems. Therefore, it is vital to incorporate input from public stakeholders during the planning process of water infrastructure projects in order to create a more holistic basis of knowledge from which decision-makers can develop the best approaches to water management.

Outreach and engagement strategies identified by the *California Water Plan Update 2013* include:

- Requiring open and transparent decision-making and access to public records.
- Requiring notification and hearings on key topics affecting the public.
- Developing education programs targeting specific fields or professions that are related to a certain project implementation.
- Developing outreach programs as part of elementary school education that emphasizes where students' water comes from and the value of water.
- Informing the public on water management problems and solutions through web sites, fact sheets, and town hall meetings.
- Collaborating with public to identify solutions through advisory committees and caucuses.
- Obtaining public feedback on decisions through public comment, focus groups, surveys, public meetings, and social media participation.

Merced Region Efforts

Examples of an outreach and engagement strategies employed by the Region is listed below.

- **Merced River Education and Enhancement Program**. This program consists of two components related to public outreach: Lower Merced River Stewardship (Component 1) and Merced Region Climate Change Awareness (Component 2). Facilitated by the East Merced Resource Conservation District, the Lower Merced River Stewardship task focuses on developing community awareness and education projects that will result in restoration activities, agricultural stewardship measures, and improved recreational opportunities. The Merced Region Climate Change Awareness task, hosted by UC Merced, promotes climate change adaption education by taking real-time streamflow and water-cycle measurements in the upper Merced watershed. This project then uses these data to inform climate change education focusing on the climate-water nexus (RMC, 2013c). This project received Proposition 84 funding and has been implemented.
- **School Education Program:** The City is implementing a school education program that includes providing educational materials and instructional assistance regarding water use efficiency. The school outreach program is specifically geared to the age of the audience from kinder to college, highlighting conservation best suited to the development level of the audience (K. Elwin, personal communication, August 15, 2018).
- **Public Education and Outreach Program:** The City has an active public information program that distributes information to the public through a variety of methods. Regular commercials air on four local radio stations (in English and Spanish), in the movie theaters, video commercials on their website, and commercials on Univision TV in Spanish. The City produces many multi-lingual educational flyers, newspaper articles, bill inserts and posters to spread the message of saving water. The City also has an active Facebook page and website (www.cityofmerced.org/savewater) (Carollo, 2017; K. Elwin, personal communication, August 15, 2018).
- **Water Conservation Coordinator:** The City employs a full-time Water Conservation Specialist who serves as the City's Conservation Coordinator. This position is active in the community and is a regular presenter of water conservation at school assemblies and classroom presentations, as well as to community groups like the Chamber of Commerce, League of Women Voters, the Merced Environmental Collective, and the Master Gardeners. In addition, the Conservation

Specialist is a regular on the local morning radio talk show, Community Conversations. Finally, the Coordinator hosts a booth to promote water conservation efforts at public events, street fairs, school festivals, and the County Fair. At these events, water conservation devices such as hose timers, shower timers, hose nozzles, and leak tablets are given out in addition to brochures and information on saving water (Carollo, 2017; K. Elwin, personal communication, August 15, 2018).

- **GSA Coordination:** Under SGMA, GSAs are required to conduct outreach during development of GSPs, including holding public workshops and making information materials available online. Outreach work will continue as GSPs develop further.

Water and Culture

Water and culture in California have a subtle and complex relationship. Water resources have defined and shaped social, cultural, and economic patterns in the state both currently and throughout its history. As a result, water management professionals and other stakeholders are recognizing the importance of connecting water resource management strategies to the cultural considerations of their communities. In planning water infrastructure projects, water resource managers recognize the need to understand the water as a cultural resource for many communities in the area. These cultural resources can include subsistence, recreation, spiritual, historic preservation, and public art activities.

Strategies for linking cultural considerations to water management identified by the California Water Plan Update 2013 include:

- Establishing an appointed preservation officer who is responsible for cultural resource stewardship.
- Establishing cultural resource management programs.
- Educating the public about the Surfrider Foundation, the Bolsa Chica $150 million settlement, Cadillac Desert, Mary Austin, Tahoe Blue, and Friends of the River,
- Educating children about how watersheds work.
- Expanding inclusion and integration of traditional and indigenous practices and knowledge in resources management and planning processes and decisions,
- Educating the public about resource stewardship activities associated with different groups and organizations.
- Centralizing information on historical and cultural resources into a single database.
- Protecting sensitive sites from vandalism.
- Investigating use of the General Planning Process to better integrate water and cultural considerations.
- Identifying efforts to implement early engagement and incorporation of culture.

Merced Region Efforts

Examples of ways that water and culture interface in the Region are listed below.

- **Consideration of Native American Tribal Lands in Environmental Documentation**. Although there are no Native American tribal communities within the Region, plan and project implementation does have the potential to impact lands that were historically occupied by Native American tribal communities. Therefore, as part of the environmental documentation process, project proponents funded through the MIRWMP under Proposition 84 were mandated to notify tribes that had traditional lands within the proposed project area.

- **Sustainable Agricultural Water Management**. Historically, agricultural water demands have dominated in the Region. In fact, agriculture is the primary land use in Merced County, accounting for over 90 percent of all land use. However, with population in the Region growing at a rapid rate, domestic water demands have increased. Therefore, in order to continue to maintain the valuable source of income the agricultural industry provides, sustainable agricultural water practices are being adapted in order to meet irrigation demands in the face of urban development. This continual assessment of how historical practices can be modified for sustainable use into the future demonstrates an understanding of how water and culture overlap.
- **Public Education and Outreach Program:** The City has an active public information program that distributes information to the public through a variety of methods. Regular commercials air on four local radio stations (in English and Spanish), in the movie theaters, video commercials on their website, and commercials on Univision TV in Spanish. The City produces many multi-lingual educational flyers, newspaper articles, bill inserts and posters to spread the message of saving water. The City also has an active Facebook page and website (www.cityofmerced.org/savewater) (Carollo, 2017; K. Elwin, personal communication, August 15, 2018).
- **Water Conservation Coordinator:** The City employs a full-time Water Conservation Specialist who serves as the City's Conservation Coordinator. This position is active in the community and is a regular presenter of water conservation at school assemblies and classroom presentations, as well as to community groups like the Chamber of Commerce, League of Women Voters, the Merced Environmental Collective, and the Master Gardeners. In addition, the Conservation Specialist is a regular on the local morning radio talk show, Community Conversations. Finally, the Coordinator hosts a booth to promote water conservation efforts at public events, street fairs, school festivals, and the County Fair. At these events, water conservation devices such as hose timers, shower timers, hose nozzles, and leak tablets are given out in addition to brochures and information on saving water (Carollo, 2017; K. Elwin, personal communication, August 15, 2018).
- **School Education Program:** The City is implementing a school education program that includes providing educational materials and instructional assistance regarding water use efficiency. The school outreach program is specifically geared to the age of the audience from kinder to college, highlighting conservation best suited to the development level of the audience (K. Elwin, personal communication, August 15, 2018).

Water-Dependent Recreation

Water-dependent recreation strategies are vital to ensuring enjoyment of water recreation activities currently and in the future. Maintaining and protecting water-dependent activities such as fishing, swimming, birding, boating, and others can provide economic, environmental, and social benefits.

Water-dependent recreation strategies identified by the California Water Plan Update 2013 include:

- Using existing data and new surveys to determine recreational needs.
- Partnering with schools to provide drowning prevention programs primarily aiming at youth from urban and low-income families.
- Developing partnerships with universities to coordinate monitoring of public recreation use, equipment, and emerging water recreation trends.
- Developing a procedure to incorporate climate change assessments within all infrastructure planning, budgeting, and project development.
- Researching, identifying, and mitigating impacts of stream flows that prevent Native Americans from participating in their traditional cultural activities.

- Developing invasive species prevention measures.

Merced Region Efforts

Examples of a water-dependent recreation strategy employed by the Region are listed below.

- **Lake Yosemite**. Various recreational opportunities are available to residents and visitors in and/or around Lake Yosemite, these include: picnicking, fishing, boating, waterskiing, wind surfing, and swimming.
- **Life Jacket Loan Program**. For three consecutive years, the East Merced Resource Conservation District has coordinated with the California Department of Boating and Waterways and McConnell State Recreation Area to implement a life jacket loan program for recreationists using the Merced River. East Merced Resource Conservation District hopes to continue the project in summer 2019.
- **Lower Merced River Recreational Boating Public Access**. This project, currently functionally completed, included construction of a public access point for safe non-motorized boat launching on the Merced River, which is frequented by floating enthusiasts and rafters. The project includes a launch ramp for non-motorized water crafts, vehicle access and parking near the river's edge, a restroom facility, trash containers and interpretive/educational panels.

Boating is a popular activity at Lake Yosemite.

5.4.8 Other Strategies

The California Water Plan Update 2013 (DWR, 2013) and the Proposition 1 IRWM Guidelines (DWR, 2016) identified other potential RMS that may aid in meeting water management goals and objectives; however, these strategies are currently limited in their ability to address long-term regional water planning needs. These strategies include:

- Crop idling for water transfers
- Dewvaporation or atmospheric pressure desalination
- Fog collection

- Irrigated land retirement
- Rainfed agriculture
- Waterbag transport/storage technology

These RMS are discussed in further detail below.

Crop Idling for Water Transfers

Crop idling is a strategy that removes lands from irrigation to make water available for transfers. Several of the potential benefits from implementing this strategy include: enhancing water supplier reliability by making water available for redistribution, enhancing water quality, protecting and restoring fish and wildlife, and helping farm communities (as well as urban areas) infuse money into the local economy while increasing the reliability of water supply for urban consumers.

Crop idling strategies identified by the California Water Plan Update 2013 include:

- Developing necessary coordination structures to satisfy agency policy requirements.
- Consulting with agencies and entities that will be leading crop idling programs.
- Understanding the local community impact and third-party impacts to develop and implement necessary actions for maintaining economic stability of local communities and mitigating socioeconomic impacts.

Merced Region Efforts

With an agricultural production value of approximately $3.4 billion annually within Merced County (Merced County, 2017), agriculture is a significant economic driver in the Region. Due to the high value of agricultural crops within the Region and the benefits that agriculture imparts to the Region's economy, crop idling is not widely implemented in the Merced Region. However, crop idling could be implemented to address groundwater overdraft and reduce agricultural water demands, especially in areas that are solely dependent on groundwater. Agricultural water demands vary by crop and agricultural use, and it is plausible that in the future the Region could implement actions to idle water-intensive crops to make water (particularly groundwater) available for water transfers and other uses.

Dewvaporation or Atmospheric Pressure Desalination

The dewvaporation or atmospheric pressure desalination strategy would heat brackish water until deposits of fresh water are collected as dew from the opposite side of a heat transfer wall. The heat sources for this strategy can be derived from multiple sources (i.e. fuel, solar, waste heat) and the energy required for evaporation can be supplied by the energy released from the dew formation.

Though dewvaporation technology is still being developed in California, Arizona State University (ASU) currently has a dewvaporation pilot project underway (DWR, 2013). ASU implemented a 5,000 gallon per day dewvaporation pilot plant that is currently being operated at the 23rd Avenue wastewater treatment plant in Phoenix, Arizona (L'Eau LLC, 2008). The potential benefits of this technology include the ability to provide small amounts of water in remote locations (basic tests have produced up to 150 gallons per day) and the ability to reclaim salt water at relatively low costs.

Merced Region Efforts

Dewvaporation or atmospheric pressure desalination is not currently being planned or explored in the Merced Region because it is not a feasible RMS. Due to low water yields expected from this strategy, it is unlikely to serve as a future water source for the Region.

Fog Collection

Fog collection is a form of precipitation enhancement that has yet to be used in California, although it does occur naturally along coastal zones (DWR, 2013). Though there is interest in using this strategy for increasing domestic water supplies in dry areas, such as California desert regions, this strategy is more appropriate for regions near the ocean.

The potential benefit of fog collection primarily includes increasing water supplies. For example, a fog collection project in Chile yielded about 2,800 gallons per day from about 37,700 square feet of collection net. However, this strategy produces limited volumes of water supply.

Merced Region Efforts

Due to climatic conditions in the Region leading to negligible amounts of fog, fog collection is not currently being implemented or explored in the Merced Region.

Irrigated Land Retirement

Irrigated land retirement is the removal of farmland from irrigated agriculture to make water available for redistribution for other uses. The potential benefits of retiring irrigated land include: enhancing water supply reliability, enhancing water quality, protecting and restoring fish and wildlife resources, reducing drainage volume and associated costs due to drainage disposal.

Strategies for facilitating irrigated land retirement programs identified by the California Water Plan Update 2013 include:

- Evaluating and ensuring urban areas receiving water made available from land retirement have exhausted all means of water conservation.
- Making all land retirement programs voluntary.
- Studying local community and third-party impacts from land retirement such as from reduced agricultural production inputs, reduced farm income, and habitat restoration.
- Developing and implementing necessary actions for maintaining the economic stability of local communities and mitigating socioeconomic impacts.

Merced Region Efforts

Irrigated land retirement is a potential RMS that is not currently being implemented in a formal way in the Merced Region. As explained above with crop idling, high agricultural productivity and resulting economic outputs from the agricultural industry in the Region make this highly unlikely in the near-term future. Irrigated land retirement - including replacing water intensive crops with agricultural uses such as grazing that do not require much, if any, irrigation - could be implemented within the Region to reduce agricultural water demands. Although this RMS may be employed in the future to make water available for transfer, it will likely only be employed on a temporary basis. Due to the importance of agriculture to the Region's economy, the majority of stakeholders do not support permanent agricultural land retirement.

Rainfed Agriculture

The rainfed agriculture strategy involves irrigating crops with natural rainfall. Potential benefits associated with rainfed agriculture include: increased water supply (though limited), improved post-harvest/pre-planting soil management for winter crops, and decreased soil erosion. However, due to the unpredictability of rainfall frequency, duration, and amount, this strategy is highly uncertain and risky. Additionally, the quantification of potential water savings from rainfed agriculture, though small, will not be possible due to lack of available information.

Strategies for implementing rainfed agriculture programs identified by the California Water Plan Update 2013 include:

- Developing new technologies, management, and efficient water management practices for rainfed agriculture.
- Providing technical and financial assistance for implementing rainfed agriculture technologies and management practices.
- Developing cooperative efforts to link rainfed agriculture runoff and water banking and conjunctive use activities and groundwater recharge.

Merced Region Efforts

Due to the abundance of agriculture in the Region and the importance of precipitation in irrigation, rainfed agriculture is an important strategy for the Region and is currently employed in the Region's rangelands.

Waterbag Transport/Storage Technology

The waterbag transport/storage technology involves diverting water in areas that have unallocated freshwater supplies, storing the water in large inflatable bladders and towing them via a tug boat to an alternate coastal region. Currently, this strategy is not used in California though there have been various proposals for this technology worldwide (DWR, 2013). Potential benefits of waterbag transport/storage technology include: improvements in drought preparedness and water quality; reductions in groundwater overdraft; and environmental, energy and water supply benefits.

Merced Region Efforts

The Merced Region is located inland and is surrounded by mountains. Because the Region lacks access to an ocean port, waterbag transport/storage technology is not currently being planned or explored in the Region, and this RMS is not applicable to the MIRWMP.

Chapter 6 Project Review Process

This chapter addresses the IRWM Project Review Process Plan Standard, which requires IRWM Plans to:

- ✓ Contain a process to select projects for inclusion in the IRWM Plan including procedures for submitting a project, reviewing projects and communicating the list of selected projects
- ✓ Consider how the project contributes to IRWM Plan objectives, how the project is related to RMS selected for use in the IRWM Plan, technical feasibility of the project, specific benefits to DAC water issues, environmental justice considerations, project costs and financing, economic feasibility, project status, strategic considerations for IRWM Plan implementation, contribution of the project in adapting to the effects of climate change in the region (including: adaptations to the water management systems, if necessary; the contribution of the project in adapting to identified system vulnerabilities to climate change effects on the region; changes in the amount, intensity, timing, quality, and variability of runoff and recharge; and the effects of sea level rise on water supply conditions and suitable adaptation measures), contribution of the project in reducing greenhouse gas (GHG) emission (including: GHG reduction as compared to project alternatives; a project's ability to help the IRWM region reduce GHG emissions as new projects are implemented over a 20-year planning horizon; and reducing energy consumption, especially the energy embedded in water use, and ultimately reducing GHG emissions), whether the project proponent has adopted or will adopt the IRWM Plan and for IRWM regions that receive water supplied from the Sacramento-San Joaquin Delta, how the project or program will help reduce dependence on the Sacramento-San Joaquin Delta for water supply
- ✓ Address specific benefits to critical water uses for Native American Tribal Communities
- ✓ Promote and prioritize projects in the selection process, while keeping in consideration the unique goals and objectives of the IRWM Region

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In order to identify water resources management projects for implementation, the Region conducted a public "Call for Projects" to solicit projects for consideration for inclusion in the MIRWMP from July 9, 2018 through August 31, 2018. Organizations from across the Region submitted a total of 41 projects addressing a wide variety of water supply, water quality, flood management, and habitat protection needs. While all of the projects included in the MIRWMP play a role in the effective management of water resources in the Region, a prioritization process was developed to help manage the project list and determine which projects best meet regional needs and objectives. The prioritization process allows projects to be ranked for implementation using a transparent method. In addition, the process encourages development and identification of projects well-suited to meet the identified needs of the Merced Region.

Throughout the IRWM planning process, the Region has engaged stakeholders across multiple areas of water resource management to identify priorities for the Region and to prioritize projects for implementation. This section presents the process for prioritization and selection of IRWM projects, including:

- Procedures for soliciting and submitting projects to the MIRWMP.
- Procedures for reviewing and prioritizing projects submitted to the MIRWMP.
- Procedures for selecting and communicating the final project list.

6.1 Project Submittal Process

The project submittal process developed during preparation of the 2013 MIRWMP was revised in 2018 to address new IRWM Guideline requirements and to reflect regional priorities. This process involves three major steps: solicitation, prioritization, and selection.

Solicitation can be described as a "Call for Projects" that help meet the Region's established objectives. The objective of this step is to compile a comprehensive list of water-related projects for the Region. Any individual(s), public agency representatives, or non-profit organization with common water interests and needs can submit a project to the IRWM program. In 2013, an online project database was developed to aid in the submittal, collection, and management of project information (www.mercedirwmp.org/projects.html). The online database (currently referred to as Merced Opti) continues to be used today and provides stakeholders with access to project information. Stakeholders can access the online project database from the MIRWM website, enter and edit project information, and submit projects for inclusion in the MIRWMP (and associated SWRP). A hard-copy project information form was also developed to allow individuals without internet access an equal opportunity to participate.

In order to submit a project, the project submitter was required to provide basic project information, including a project description and discussion of how the project contributes to IRWM objectives, water-related benefits, estimated costs, project status, and project sponsor information. The online project database allows this project information to be reviewed, organized, and easily updated by the project proponent. Access to project summaries is also available via the online project database to all interested parties with the goal of improving transparency and encouraging integration. Anyone, including members of the public, may create an online project database account and view project information. Figure 6-1 presents a screenshot of the Merced IRWM website page that contains the online project database.

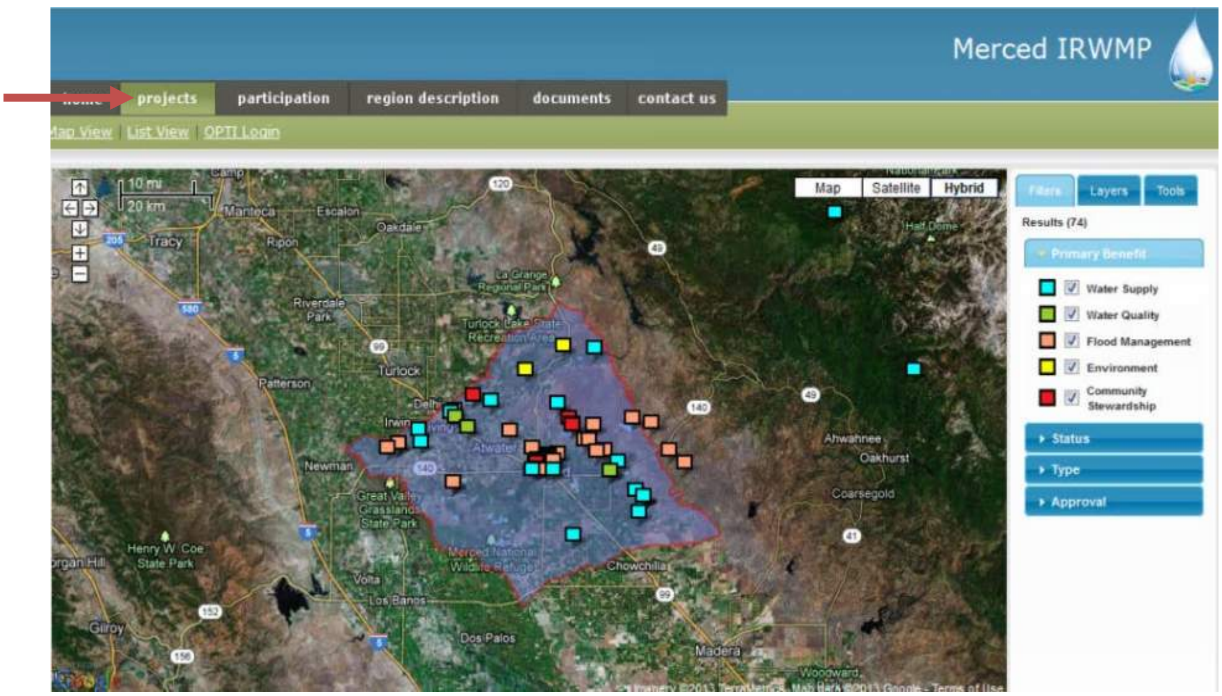
Project solicitation was announced to the public through various channels beginning in early July 2018. Notices regarding the Call for Projects were sent to Merced IRWM stakeholders via email, and advertisements were placed on the Merced IRWM website. The Merced Region also published a Notice of Intent to update the MIRWMP in the *Merced Sun*-Star and *Vida en el Valle* on June 29, 2018 and July 4, 2018; this notice also announced a Public Workshop, which was held on July 11, 2018 to discuss the MIRWMP update, as well as the project submittal process and answer stakeholders' questions. An online project database webinar was held on July 10, 2018; this webinar gave step-by-step instructions on how to input project information into the online project database. Additionally, individual coordination was conducted with project proponents who submitted projects in 2013 in order to determine whether they wanted to include their projects in the 2018 MIRWMP. Throughout the Call for Projects, technical support was provided to online project database users.

Project submittals were requested beginning July 9, 2018, with a submittal deadline of August 31, 2018. While projects can continue to be modified and new projects can be submitted for consideration for inclusion in the MIRWMP, only projects submitted on or before August 31, 2018 are listed in the snapshot of projects presented in this MIRWMP. It should be noted, however, that the list of projects presented in this MIRWMP is not the official project list; the official project list, which is continually updated and revised, resides in the online project database accessible through the MIRWM planning website (http://mercedirwmp.org/projects.html). This MIRWMP does not require revision, update, or re-adoption following changes to the living project list.

In order to facilitate review and organization of the project submittals, the Merced online project database provides the option of printing or exporting a detailed list of all projects submitted. This project list was used in discussions of submitted projects with the RAC and other stakeholders.

The online project database is open at all times for submittal of new IRWM projects as well as editing and revising existing projects. As MIRWMP updates and new funding opportunities arise, the Merced Region will issue new Calls for Projects with deadlines appropriate to those opportunities. Projects at all stages of development were and will continue to be accepted into the project database and MIRWMP, ranging from conceptual planning projects to implementation-ready construction projects.

Figure 6-1: Merced IRWM Program - Project Submittal Website



6.2 Project Review Process

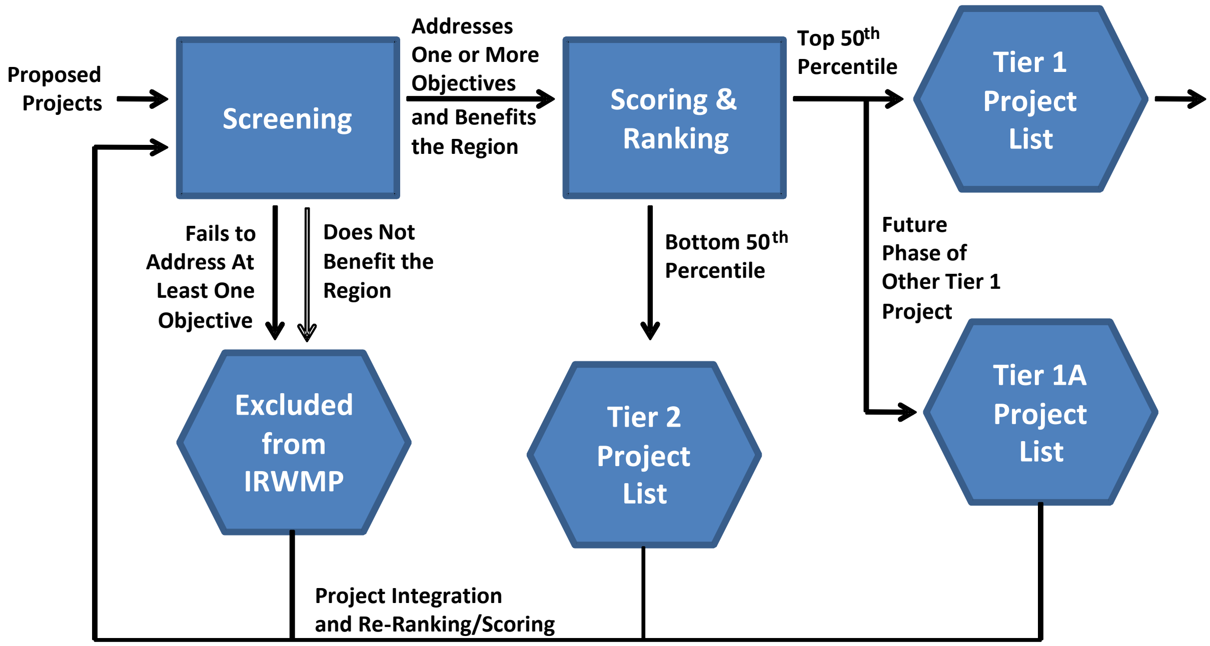
After the August 31, 2018 deadline, projects submitted through the open Call for Projects were reviewed, ranked, and prioritized using a two-step screening and scoring approach. Figure 6-2 below illustrates the overall process for screening of projects for the IRWM Program. As shown in this figure, projects submitted for consideration were first evaluated for consistency with the Merced IRWM objectives that were developed by the RAC as explained in Chapter 4, Objectives. Projects that did not meet any regional objectives were excluded from the MIRWMP. Projects were also screened based on their ability to provide benefits to the Merced Region. Projects included in the MIRWMP do not need to be physically located within the Region, but the benefits of the project must accrue at least in part to the Region. Projects that were found to meet at least one objective with benefits to the Region passed the screening process and moved on to the next step of the project review process: scoring and ranking. All projects submitted during the 2018 Call for Projects met the initial screening process.

To evaluate and prioritize projects as part of the IRWM planning process, the scoring and ranking process takes into account three fundamental components:

- Principles of IRWM planning,
- Feasibility of projects to proceed, and
- Other regional priorities.

As described in Chapter 4, Objectives, prioritization of objectives was revisited and performed for the 2018 MIRWMP Update at an in-person RAC meeting held in May 2018. As such, the components established above were used to prioritize projects along with the prioritized program objectives. Scoring criteria were developed for each component as illustrated in Table 6-1.

Figure 6-2: Prioritization Process Overview



Through facilitated meetings, the RAC established the relative importance of each of these criteria. The approach to scoring projects and the relative importance of each criterion is presented in Table 6-1**.** Project scoring was developed to identify projects that:

- Address IRWM Plan objectives,
- Integrate multiple RMS,
- Link to / integrate with other projects,
- Are identified in existing plans,
- Demonstrate technical feasibility,
- Provide a positive benefit-cost,
- Benefit DACs,
- Directly address a critical water supply or water quality need of a DAC or address an environment justice issue,
- Assist the region in adapting to effects of climate change or mitigating effects, and
- Are locally supported.

Each project was evaluated with respect to the criteria presented in Table 6-1**.** For each criterion, a project could receive a raw score of up to 100 points. The raw scores were then weighted by a percentage to reflect the relative importance of the different prioritization criteria. Based on the outcome of this evaluation, each project received a final, weighted score of up to 100 points. Projects were then ranked with the highest-scoring project ranked as number one. Projects within the top 50th percentile (i.e., all projects with scores greater than the median score) were designated as Tier 1 projects that strongly contribute to the attainment of regional goals and objectives. Future phases of Tier 1 projects were considered Tier 1A projects, as they would not be considered to be high priorities for implementation until after the related Tier 1 projects had been completed. The bottom 50th percentile (i.e., all projects below the median) were considered Tier 2 projects. While these projects are considered to be important for achieving the Region's water resources management objectives, they are not currently considered the Region's highest priorities for implementation.

Scoring for each submitted project was based on the project information provided in the online project database. In 2018, no projects were submitted using the hard copy submittal form; in the future, if hard copy forms are used, responses will be entered into the online project database (likely by members of a designated RAC subcommittee). Project proponents remain responsible for ensuring that their project information is accurate in the online project database, as this information forms the basis for ranking projects.

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Table 6-1: Project Scoring Guide

Component	Criterion	Scoring Procedure	Raw Score Assigned	% of Score	Subtotal
1. Principles of IRWM Planning	Addresses IRWM Plan Objectives	Score based on # of objectives addressed with priority objectives counting as two objectives	6+ objectives = 100 pts 5 objectives = 80 pts 4 objectives = 60 pts 3 objectives = 40 pts 2 objectives = 20 pts	15	25
	Employs Multiple Resource Management Strategies	Score based on # of strategies employed	8+ strategies = 100 pts 6-7 strategies = 75 pts 4-5 strategies = 50 pts 2-3 strategies = 25 pts	10	
2. Project Status and Feasibility	Is Ready to be Implemented	Score based on degree of work needed prior to implementation	Ready to construct / implement (or is a paper study) = 100 pts Preliminary Design Completed = 75 pts Planning Completed = 50 pts Planning in Progress = 25 pts No Work Completed = 0 pts	7	30
	Is Technically Feasible	Score based on technical feasibility documentation	Feasibility documentation is available, or explanation of feasibility is provided = 100 pts No feasibility information is provided = 0 pts	8	
	Is Economically Feasible	Score based on estimated benefit-cost ratio	B:C Ratio = 4 = 100 pts B:C Ratio ≥ 3 and < 4 = 75 pts B:C Ratio ≥ 2 and < 3 = 50 pts B:C Ratio ≥ 1 and < 2 = 25 pts B:C Ratio < 1 = 0 pts	8	
	Has a Local Funding Match	Score based on status of local funding match	Local funding match secured = 100 pts Local funding match not secured and project is in an unincorporated area = 50 pts Local funding match not secured = 0 pts	7	

Component	Criterion	Scoring Procedure	Raw Score Assigned	% of Score	Subtotal
3. Other Regional Priorities	Benefits Disadvantaged Communities	Score based on providing targeted benefits to more significantly disadvantaged communities within the Region, considering household income and unemployment rate	Project directly benefits Planada, El Nido or Franklin/Beachwood = 100 pts Project directly benefits Le Grand or Winton = 75 pts Project directly benefits Atwater, Snelling, Livingston, Stevinson, or DAC areas of City of Merced = 50 pts Project directly benefits regional community, but benefits not targeted to a specific DAC = 25 pts Does not provide a benefit to a disadvantaged community = 0 pts	9	45
	Directly Addresses a Critical Water Supply or Water Quality Need of a Disadvantaged Community	Score is based on whether the project addresses one of the critical needs identified by the DAC Outreach effort	Yes = 100 pts No = 0 pts	10	
	Addresses an existing environmental Justice (EJ) issue or provides benefits to disadvantaged underrepresented communities, including unincorporated areas.	Score is based on Yes/No response	Yes = 100 pts No = 0 pts	4	
	Provides benefits to Native American Tribal Communities	Score is based on Yes/No response	Yes = 100 pts No = 0 pts	0	
	Contributes to Climate Change Adaptation or Mitigation	Score is based on number of adaptation and mitigation questions addressed	Yes to 3+ questions = 100 pts Yes to 1-2 questions = 50 pts Yes to 0 questions = 0 pts	11	
	Supported by Multiple Local Project Sponsors	Score is based on # of local project sponsors working together to implement the project	4+ local project sponsors = 100 pts 3 local project sponsors = 75 pts 2 local project sponsors = 50 pts 1 local project sponsor = 25 pts	11	
Total					

The following subsections outline the project selection factors identified by DWR IRWM Plan standards as well as additional factors developed by the RAC for use in the project prioritization process. The scoring criteria were arranged into three categories as described below: (1) Principles of IRWM Planning, (2) Project Status and Feasibility, and (3) Other Regional Priorities. Appendix D provides a snapshot of projects included in the MIRWMP (as of August 31, 2018) and includes a summary of points awarded in each portion of the project prioritization process.

6.2.1 Principles of IRWM Planning

Addresses IRWM Plan Objectives

As described in detail in Chapter 4 Objectives, the RAC developed twelve specific objectives for the Merced Region through a series of facilitated public workshops and meetings. These objectives address major water-related issues and conflicts in the Region and provide a summary of the Region's water-related priorities. At the RAC meeting held on May 24, 2018, the RAC prioritized objectives, determining that the top priorities for the Region are Objectives A, B and C.

The Region's twelve regional objectives are:

- Correct groundwater overdraft conditions.
- Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management.
- Meet demands for all uses, including agriculture, urban, and environmental resource needs.
- Improve coordination of land use and water resources planning.
- Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure.
- Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible.
- Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.
- Protect, restore, and improve natural resources.
- Address water-related needs of DACs.
- Protect and enhance water-associated recreation opportunities.
- Establish and maintain effective communication among water resource stakeholders in the Region.
- Enhance public understanding of water management issues and needs.

Contribution to the achievement of the MIRWMP objectives provides a measure of the degree to which the project will address the Region's water resource management challenges. Projects submitted for inclusion in the MIRWMP are scored based on how well each project contributes to the objectives, up to a maximum of 100 points. The scoring for this criterion was developed such that contribution to the priority objectives for the Region (i.e. Objectives A, B and C) was given twice the weight of other objectives.

Employs Multiple Resource Management Strategies

Chapter 5, Resource Management Strategies, identifies the RMS deemed appropriate for the Region. Table 5-2 (see Chapter 5 Resource Management Strategies) presents the MIRWMP objectives and their correlation to each RMS included in the MIRWMP. Project proponents submitting projects for consideration in the MIRWMP are required to identify both the IRWM Plan objectives and the specific RMS employed by the project.

IRWM planning is intended to encourage integrated regional strategies for management of water resources that yield multiple benefits, and the number of RMS employed by a project is included in the MIRWMP project scoring process to give priority to projects that demonstrate greater resource integration.

6.2.2 Project Status and Feasibility

Is Ready to be Implemented

Project status, also known as "readiness to proceed," is considered during project prioritization as required by the Project Review Process Plan Standard in that projects are scored based upon the degree of work required before they can be implemented, and current status of completion. However, the RAC and RWMG recognize that readiness to proceed is not necessarily a reason to exclude projects from the MIRWMP. As the MIRWMP planning horizon is 20 years, even a conceptual project may be considered as it could generate benefits within the planning horizon.

Project status was assessed based on project proponents' responses to questions related to the status of planning, design, environmental documentation and permitting efforts. Projects that were either a feasibility study, plan development, or other paper study were considered ready to be implemented and thus received the maximum possible score.

Is Technically Feasible

The technical feasibility of submitted projects is considered during the project review process. Technical feasibility is related to the knowledge of the project location; knowledge of the water system at the project location; or the material, methods, or processes proposed to be employed in the project. Technical feasibility of each project submittal is assessed based on the availability of feasibility documentation as demonstrated by project proponent's responses to the following questions in the project information collection process: feasibility studies that have been completed for the project, planning documents that identify the project, regulatory permits that have obtained for the project, and completion of environmental documentation. Projects were awarded points in this category according to documentation provided.

Is Economically Feasible

As part of the project selection process, the economic feasibility of each project was considered. Project proponents were asked to submit estimated capital and operating costs, project lifecycle, and expected benefits.

As required by the Project Review Process Plan Standard, the project selection process included a preliminary assessment of the economic feasibility of each submitted project. A simulated benefit-cost ratio was developed for each project as described below.

Calculating Simulated Benefit-Cost Ratio

The Proposition 1 Guidelines require an economic assessment such as development of a benefit-cost ratio to be used in reviewing projects for inclusion in the MIRWMP. Projects submitted to the MIRWMP are at a variety of different planning stages; some may be ready to construct and have benefit-cost ratios already developed or easily calculated, while others may be preliminary concepts, and the costs and benefits of the projects are unclear. As such, for the purposes of the Plan evaluation, a simulated benefit-cost ratio was developed.

Calculating Benefit

In developing the benefit score to be used in the benefit-cost ratio, the benefit was calculated based on the number of objectives achieved. Prior to completing a grant application, a full qualitative and quantitative benefits analysis may need to be completed. However, given the disparate level of detail of projects submitted, objectives were used as a surrogate for benefits to provide a consistent way of comparing projects. Benefit scores were assigned as follows.

- 4 or more objectives = 4 pts
- 3 objectives = 3 pts
- 2 objectives = 2 pts
- 1 objective = 1 pts

Calculating Cost

The project solicitation form requests information on capital and operations and maintenance (O&M) costs associated with each project, as well as base year for costs provided and project life. If neither capital nor O&M costs were provided in the project application, the project automatically received the lowest score possible (0 pts). If capital costs were provided but O&M costs were not provided, annual O&M costs were estimated to be 10% of capital cost (if the project submittal indicated that the O&M costs were $0/year, $0/year was used). If the project life was not provided, the project life was assumed to be 20 years. If a base year for cost information was provided, costs were escalated to 2018 costs; however, if a base year was not provided, costs were assumed to be in 2018 dollars.

Present value cost was then calculated in 2018 dollars as follows:

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

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

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

where *i* is the discount factor. For consistency with past DWR guidelines, a discount factor of 6% was applied for all projects.

Cost scores were then assigned as follows.

- Present Value Cost ≥ $5 M = 4 pts
- $2 M ≤ Present Value Cost < $5M = 3 pts
- $1 M < Present Value Cost < $2M = 2 pts
- Present Value Cost ≤ $1M = 1 pt

Calculating Simulated Benefit-Cost Ratio

Simulated benefit-cost ratios were then calculated for each project by dividing the benefit score (up to 4 pts) by the cost score (up to 4 pts). The resulting simulated benefit-cost ratio ranges from 0.25 to 4. Projects with benefit-cost ratios less than one received a score of 0 points. Projects with a simulated benefit-cost ratio of one or greater received up to 100 points, with projects with greater simulated benefit-cost ratios receiving higher scores. Complete benefit-cost calculations are included in Appendix D.

Has a Local Funding Match

Projects also received scores based on whether or not a local funding match had been secured. Projects received a full 100 points if a local funding match has been secured. However, in order to recognize that projects in unincorporated areas may have difficulty in securing a funding match (since no municipal sources of funding exist), projects located in an unincorporated area were awarded 50 points. Projects located in incorporated areas without a funding match received no points.

6.2.3 Other Regional Priorities

Benefits to DACs, Native American Tribal Communities and Environmental Justice (EJ) Considerations

DACs, Native American Tribal Communities, and EJ considerations are captured through multiple scoring criteria including: Benefits DACs; Directly Addresses a Critical Water Supply or Water Quality Need of a DAC; Addresses an Existing EJ Issue or Provides Benefits to Disadvantaged Underrepresented Communities, Including Unincorporated Areas; and Provides Benefits to Native American Tribal Communities. The State defines a DAC as a community with an annual MHI that is less than 80% of the statewide annual MHI. Based on estimates of MHI from the U.S. Census ACS from 2012-2016, 80% of the statewide MHI equals $51,026 (U.S. Census, 2017).

EJ is defined in California law (Government Code §65040.12) as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations and policies." EJ in water management includes:

- Supporting community health, as well as a clean and safe environment.
- Diversifying the decision-making process by calling for involvement of all people and communities.
- Encouraging a more equitable distribution of economic benefits.
- Empowering communities themselves to take action towards improving their environment.
- Increasing awareness, understanding and effective cooperation within and among communities.
- Ensuring the right of all people to equal and fair treatment under the laws and regulations of the United States.

The project selection process used to develop the MIRWMP project list considered whether or not projects benefit DACs or address existing EJ issues using four criteria.

The first criterion considers the degree of economic distress experienced by communities served by the project with projects targeted to communities in greater distress receiving additional points. If a project was found to benefit multiple DACs, the highest number of points possible were awarded (i.e., based on the most disadvantaged community benefitted). The RAC grouped the Region's DACs into scoring tiers based on a combination of the communities' MHI as viewed by census place, and local knowledge of economic conditions.

The second criterion considers whether the project directly addresses a critical water supply or water quality need of a DAC. Scores were awarded for this criterion based on whether the project proponent selected "Yes" or "No" in response to the applicable question in the online project database form. The first criterion considers projects with general DAC benefits, while this second criterion reflects the Region's emphasis on completing projects that may be critical for DACs but may be less wide-ranging or meet fewer objectives due to a narrower scope.

The third DAC/EJ criterion considers specific EJ needs of the communities with projects addressing an existing EJ issue given priority over those which do not. Projects benefitting disadvantaged underrepresented communities (such as unincorporated areas) also received points in this category.

Finally, a fourth criterion is included for projects that provide benefits to Native American Tribal Communities. This criterion acts as a placeholder; it was given a weight of zero since no State- or federally-recognized Native American Tribal communities are present in the Merced Region. Should any tribes be recognized in the Region in the future, the weight of this criterion could be adjusted in order to award points to projects that provide this benefit.

The "Call for Projects" was open to any public agency or non-profit organization, including DACs, who wanted to submit water projects within the Region.

Contributes to Climate Change Adaptation or Mitigation

As required by the Guidelines, the project review process included consideration of climate change adaptation and mitigation. Projects that assist the Region in adapting to climate change and projects that mitigate climate change through GHG reduction or offset were awarded additional points in the prioritization process based on information provided by the project proponents in the online project database form.

Supported by Multiple Local Project Sponsors

In developing the project review process, the RAC considered whether projects in the MIRWMP should be limited to those sponsored by local project proponents. After discussion on this topic, the RAC determined that any project that meets the objectives of the MIRWMP and provides a benefit to the Region should be included in the plan, regardless of who proposed the project or the physical location of the project. Projects do not need to be sponsored by a local entity; however, preference is given to projects that are led by local agencies and organizations or neighboring IRWM Regions. A greater number of points were awarded to projects that involve collaboration among a greater number of local entities or neighboring IRWM Regions. Having multiple project sponsors is also an indication of project integration as it requires collaboration among the sponsors to develop a project that meets the needs of their respective agencies and organizations.

6.2.4 Supported by an Adopting Entity

The Proposition 1 Guidelines require the project review process to consider whether the project proponent will adopt the MIRWMP as part of the project review process. In compliance with this requirement, applicants were asked when submitting their project whether their entity would be willing to adopt the completed MIRWMP. The responses were recorded but were not used to score the projects.

6.3 Communicating the List of Selected Projects

The MIRWMP project list, as of August 31, 2018, is included in Appendix D of this MIRWMP. The up-to-date project list can be accessed through the Merced online project database, which is accessible through the projects module of the MIRWMP website (http://www.mercedirwmp.org/projects.html). The Merced online project database allows project proponents to add projects at any time, update project information, review other projects, and identify integration opportunities to enhance the benefits provided by the projects. The online database allows the project list to remain a "living document," always available for review and update. The MIRWMP does not require update, revision, or re-adoption following changes to this project list.

The MIRWMP project list should be periodically updated and reviewed through formal requests for projects to ensure that new projects are continually considered for upcoming funding opportunities and that new projects are added to respond to evolving regional conditions. Further, formal updates provide a reminder for project proponents to update and revise their project submittals as necessary to maintain currency. As new funding opportunities arise, MIRWMA and the RAC will communicate new project submittal deadlines and other relevant information to the stakeholder list and the public.

Merced Integrated Regional Water Management Plan

Chapter 7 Impacts and Benefits

This chapter addresses the IRWM Impact and Benefit Plan Standard which requires IRWM Plans to:

- ✓ Discuss potential impacts and benefits of plan implementation
- ✓ Contain a screening level discussion of impacts and benefits within the IRWM Region, between regions, and those directly affecting disadvantaged communities, environmental justice related concerns and Native American Tribal communities
- ✓ State when more detailed project-specific impact and benefit analyses will occur

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This section describes the potential impacts and benefits that could occur through MIRWMP and project implementation. More detailed analyses of project benefits and impacts will occur as projects near construction, such as through CEQA or NEPA evaluation.

The MIRWMP consists of a planning study and basic data compilation that would not result in the disturbance of any environmental resource. These activities are exempt from CEQA pursuant to CEQA Guidelines §15262 and §15306. As such, programmatic environmental analysis under CEQA is not required. Furthermore, implementation of each project included in the MIRWMP will be the responsibility of the project proponent and any applicable project partners. Project proponents bear full responsibility for ensuring all regulatory requirements for the project are met.

7.1 Plan Implementation Benefits and Impacts

The MIRWMP objectives discussed in Chapter 4, Objectives, were developed to address various water management issues faced by the Merced Region. While the purpose of these objectives is to promote beneficial actions, MIRWMA and the RAC recognize implementation of the MIRWMP will result in benefits as well as impacts as various resource management strategies are employed regionally, inter-regionally and/or locally. Potential benefits and impacts are identified in Table 7-1 and discussed in the following sections. The discussion of benefits and impacts will be revisited during IRWMP updates or as needed to ensure that it represents current information.

7.1.1 Regional Benefits and Impacts

Benefits

Implementation of the MIRWMP will generate a variety of benefits to the Merced Region, including the following:

- **Improved flood management.** Flooding is a significant challenge for the Merced Region and addressing this is one of the Region's highest priority objectives. Improved conveyance and storage, system reoperation, ecosystem restoration, urban stormwater runoff and sediment management, surface and groundwater storage, and land use planning and management strategies can reduce flooding and flood impacts in the Region.
- **A more reliable and high-quality water supply.** Additional water supplies, conjunctive management, and increased water use efficiency will lead to improved water supply reliability and quality. Economic and environmental health is directly linked to reliable and high-quality water and implemented projects will ensure that existing water quality is sustained and protected.

- **Reduced groundwater overdraft/subsidence**. Decreasing overall water demand and groundwater pumping is the most effective way to reduce groundwater overdraft and subsidence. This can be achieved by either creating new supplies or maximizing current supply through conservation or increased efficiency.
- **Improved habitat.** Strategies that improve habitat include those which improve water quality (such as pollution prevention and runoff management) and resource stewardship (such as agricultural lands stewardship, preservation of open spaces, protection or management of forest and riparian communities, and removal of invasive species).
- **Increased public health and safety.** Flood management and recreational strategies can increase public health and safety. Flood management strategies reduce the impacts of flooding on homes, water supply infrastructure and sources, and more importantly loss of life. Recreational strategies increase public health and safety by providing safe access to waterways and encouraging communities to be more active.
- **Cost-effective and multi-benefit projects.** Multi-benefit projects provide increased value by achieving goals and objectives for multiple stakeholders rather than a single entity. Integrated planning and collaboration promote cost- and resource-sharing opportunities as well as avoid duplicating efforts. These allow existing resources to be optimized and larger-scale efforts to be developed while providing cost savings to both stakeholders and their communities.
- **No-regrets adaptation**. MIRWMA, the RAC, and stakeholders can invest in projects that will reduce the Region's vulnerability to climate change risks while still meeting current needs by implementing projects that address current and anticipated future conditions. This allows projects to provide benefit to the Region regardless of whether and to what degree projected climate change impacts are experienced in the future.
- **Shared experience and resources.** Regional needs can be more effectively met through MIRWMP implementation as knowledge and resource sharing is promoted among agencies and stakeholders. In addition to the direct quantitative benefits of MIRWMP implementation, such as new or more reliable water supplies, indirect benefits associated with avoided negative impacts of non-action are expected to be realized.
- **Increased regional understanding.** By addressing regional challenges as a cohesive group through IRWM planning, agencies and stakeholders develop a deeper understanding of the benefits and impacts of individual projects on other agencies and stakeholders. This comprehensive approach reduces interagency conflicts that could otherwise prevent projects from gaining the necessary support for successful implementation.
- **Improved local understanding of water resources issues.** Local understanding of water resource conflicts and solutions will improve through consistent and coordinated public outreach and education. Maintaining a consistent message will improve and encourage public understanding of water resource management issues and acceptance of integrated projects. The formation of MIRWMA will ensure the continuation of this concept beyond the IRWM funding cycles or the program.

Impacts

The complete impacts of MIRWMP implementation may be identified on an individual project basis during CEQA and / or NEPA analysis. It is assumed that every effort will be made by project proponents to mitigate impacts in accordance with CEQA and NEPA requirements. Potential impacts of MIRWMP implementation could include the following:

- **Reduced groundwater recharge**. While water use efficiency can reduce the Region's overall demand and groundwater pumping, projects which improve irrigation efficiency can lead to reductions in groundwater recharge in areas supplied with surface water.
- **Reduced instream flows**. Instream flows can be impacted by projects which increase reliance on surface water supplies or projects which decrease agricultural drainage flow by increasing water use efficiency. Flood management strategies can also reduce instream flows, as natural floodplain restoration facilitates flow out of the stream channel.
- **Degraded water quality.** While MIRWMP implementation promotes the protection and improvement of water quality, various strategies have the potential to produce negative impacts. For example, a measure to match water quality to intended use could result in some users receiving a reduction in their water quality even though it would remain sustainable for their use. Even regional initiatives that increase water supply and use, such as increased recycled water use or protection of instream flows for recreational activities, can come at the risk of negative impacts. Recycled water is expected to have a higher concentration of salts than the Region's surface water supplies, so replacement of surface water with recycled water for agricultural or landscape irrigation could degrade the end user's water quality and increase salt nutrient loading to the groundwater basin. Increased salt loading can also result from saline groundwater intrusion due to increased groundwater pumping. Increased recreation can also degrade water quality by increasing erosion and sedimentation.
- **Construction-related impacts.** Dust, noise, and traffic generation can all result from project implementation. Construction of new infrastructure could also lead to long-term disturbance or even loss of habitat and wildlife. For example, a new treatment plant could have long-term noise and traffic impacts that affect wildlife, or a new reservoir could permanently displace wildlife by inundating habitat.
- **Restricted river access**. Construction of new dams or levees could restrict access or navigation of the Region's rivers and impact river recreation, an important no-cost resource for the Region. Such strategies however are unlikely in the Merced River corridor.
- **Growth inducement**. Improved flood management and water supply and quality can promote large-scale land and economic development, which can have other adverse impacts.
- **Land use restrictions**. Land use restrictions may be implemented for a variety of reasons including removal of structures from flood zones, protection of recharge areas, and protection of critical habitat and wildlife.
- **Economic impacts**. Improved water and natural resource management and land use restrictions are likely to increase costs to end water users and property owners. The economic incentives RMS can also lead to short-term economic impacts for agencies sponsoring incentives such as water use efficiency rebates.

- **Increased energy use**. New water treatment facilities and conveyance strategies that involve pumping water and system reoperation to meet the Region's increasing water demand can result in a greater contribution to GHG emissions.

7.1.2 Interregional Benefits and impacts

Benefits

Meeting the objectives of the MIRWMP not only benefits the local agencies and residents of the Merced Region, but also neighboring IRWM regions (Mariposa-Yosemite, Madera, East Stanislaus, and Westside-San Joaquin Regions) and members of the public throughout California by helping to meet statewide priorities. Specific ways in which attainment of the MIRWMP objectives could provide benefits beyond the Merced Region include:

- **Reduced flooding.** Increasing the capacity of reservoirs and channels upstream of the Merced Region could reduce flood risk to communities upstream, within, and downstream. Projects that put flood flows to beneficial use within the Merced Region could reduce flooding to downstream communities.
- **Improved water quality**. Improved flood and stormwater management, restoration of riparian areas, and rehabilitation of aging water and wastewater infrastructure may enhance Merced and San Joaquin River water quality. Improved quality of runoff and effluent discharges into the rivers may also improve water quality further downstream in the Delta.
- **Improved water supply reliability**. Reducing water demands through improved water use efficiency will reduce future competition over interregional surface and groundwater sources and improve supply reliability. Correcting overdraft conditions within the Region will also increase water supply reliability for communities and agencies outside the Region.
- **Protection or improvement of fish and wildlife passage.** Protecting the Merced Region's open space and agricultural lands maintains wildlife corridors used by species that move across the Region's boundaries.
- **Climate change response actions.** Water and wastewater system projects that lead to reductions in energy use, or that use or generate green energy, benefit all of California by reducing GHG emissions and potential climate change impacts. Increased reliability or efficiency of water supplies also benefits California by maximizing existing resources, as reduced snowpack concentration and runoff due to climate change can lead to decreased instream flows and groundwater recharge.

Impacts

Potential interregional impacts of MIRWMP implementation may include:

- **Changes in streamflow**. Increasing flood flows or decreasing instream flows downstream of the Region resulting from upstream channel modifications, operational changes or land use changes could result in changes to streamflow within and outside the Region.
- **Degraded water quality**. Flood management that increases channel capacity within the Merced Region can increase flows in downstream channels outside the region if they have less capacity, resulting in increased erosion and sedimentation in these reaches. Recreational activities can cause erosion and increase downstream sedimentation, over-pumping can impact the groundwater

basin's quality, and recycled water use or initiatives that match quality to use can increase salt and nutrient loading to the groundwater basin.

- **Reduced water availability and reliability**. The Merced Region's increased dependence on interregional surface water supplies could reduce the availability and reliability of these supplies for neighboring regions.
- **Restricted wildlife passage**. Infrastructure projects could cause fragmentation of habitat types and separate wildlife corridors used by species that migrate across the Region's boundaries.
- **Construction-related impacts**. MIRWMP infrastructure projects located outside the Merced Region could have temporary construction-related impacts as well as permanent loss of habitat, which is assumed to be fully mitigated in accordance with CEQA and / or NEPA requirements.

7.1.3 Benefits and Impacts to DACs, Environmental Justice-Related Concerns, and Native American Tribal Communities

Since the majority of the Merced Region is currently classified a DAC, potential impacts are the same as identified in Section 7.1.1. Protection of these people and economies is a priority for MIRWMA and the RAC and thus, impacts will be kept to a minimum and ongoing coordination and public involvement will aid in preventing a disproportionate share of impacts from being borne by the most economically-distressed communities. The commitment of MIRWMA and the RAC to providing benefits to DACs now and in the future is evidenced by the MIRWMP objective of addressing water-related needs of DACs and the inclusion of scoring criteria related to DACs and EJ in the project prioritization process. Flood flow management for public safety, water supply, recharge, and natural resource management also benefits DACs and is one of the Region's highest priority objectives. While much of the Merced Region is located within the 100-year floodplain, recurring floods in recent decades prove significant areas in the region are prone to flooding from storm events less severe than a 100-year event. Management of these floods, which endanger the health and safety of communities and threaten the habitability of dwellings, is a critical water quality need for DACs in the Region.

EJ is addressed by ensuring that all stakeholders have access to the MIRWMP planning decision-making process and that minority and/or low-income populations do not bear disproportionate adverse human health or environmental impacts from Plan and project implementation. EJ is addressed through the Merced Region's open and transparent IRWMP planning process. Conducting public workshops and utilizing the existing Merced IRWMP website, as well as the online project database, allows for DACs, climate vulnerable communities, and members of the public to participate in the IRWMP planning process, regardless of financial contribution. Construction of project facilities, which can have short-term or long-term impacts such as noise and traffic disruption for neighboring communities, is often an EJ concern. Prior to implementing projects as part of the MIRWMP, MIRWMA and the RAC recommend that project proponents do a preliminary analysis of the areas that could be affected by construction of project facilities to ensure that construction nuisance impacts and long-term impacts will not be borne disproportionally by any minority population or low-income group.

EJ issues include small community water systems' water quality, private domestic well groundwater quality, flooding that impacts low income areas, and areas with inadequate wastewater collection and treatment capacity. Small community water systems' water quality can be a potential issue because of either identified, unaddressed water quality issues or significant cost of treatment to address an identified issue that results in the solution being cost-prohibitive. Groundwater contamination poses a similar threat in areas with private wells used for domestic supply or where households cannot afford to purchase bottled water as an alternative drinking water supply. Flooding can disproportionately affect low-income areas because the benefit-cost ratio for flood projects in affluent areas are typically higher (due to the increased value of at-risk property) than in low-income areas; as such, it may be easier to justify and initiate flood protection projects that benefit more affluent areas. Inadequate wastewater collection and treatment capacity also has the potential to be an EJ issue due to the cost of increasing wastewater conveyance, treatment, and disposal capacity.

In pursuing future regional grant opportunities, MIRWMA and the RAC will ensure that agencies and stakeholders representing potential EJ areas have equal access to participate in the Region's project selection processes. However, local funding match requirements that are often required by grant programs may prohibit these agencies from being able to compete for funding. In situations in which local funding match requirements can be waived (e.g., often available through the IRWM implementation grant process) or the agencies are able to provide match, MIRWMA and the RAC will work to ensure small community projects are given due consideration and are not consistently deferred in favor of agencies serving greater populations or agencies with greater resources.

Since there are no state- or federally-recognized Native American tribal communities within the Merced Region, MIRWMP and project implementation do not pose any direct benefits or impacts to these communities. As part of the environmental documentation process, project proponents funded through the MIRWMP and the associated IRWM grant program will be required to provide notification of the proposed project to tribes that had traditional lands within the proposed project area (as part of AB 52).

7.2 Project or Program Benefits and Impacts

A summary of MIRWMP projects and the objectives they address is included in Table 7-1. For each project, potential benefits and impacts are assumed to be similar to those identified for the resource management strategies they employ.

Table 7-1: Potential Benefits and Impacts of MIRWMP Implementation

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	Potential Impacts	Potential Benefits	Potential Impacts
Reduce Water Demand				
Agricultural Water Use Efficiency	Increased water savings Reduced groundwater overdraft/subsidence Improved water supply reliability Decreased operational costs/increase energy efficiency Improved coordination of land use and water resources planning Avoided cost of purchasing new supplies or developing new supply infrastructure Runoff reduction/pollution prevention	Reduced groundwater recharge in areas supplied with surface water Reduced instream flows, including loss of agricultural drainage flow to downstream water users	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	Reduced instream flows, including loss of agricultural drainage flow to downstream water users
Urban Water Use Efficiency	Increased water savings Reduced groundwater overdraft/subsidence Improved water supply reliability Decreased operational costs/increase energy efficiency Avoided cost of purchasing new supplies or developing new supply infrastructure Runoff reduction/pollution prevention	Reduced groundwater recharge in areas supplied with surface water Reduced instream flows, including reduction of municipal wastewater discharges	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	Reduced instream flows, including reduction of municipal wastewater discharges
Improve Operational Efficiency and Transfers				
Conveyance- Regional/Local	Reduced groundwater overdraft/subsidence, including reduced threat of flooding from levee subsidence Reduced flooding Improved coordination of land use and water resources planning Improved water supply reliability Improved water quality, including protection of groundwater quality Improved water use efficiency Improved natural resources	Reduced instream flows Restricted wildlife passage Increased energy use Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Reduced flooding	Reduced instream flows Restricted wildlife passage Construction related impacts, including disturbance of habitat and wildlife
System Reoperation	Reduced groundwater overdraft/subsidence Reduced flooding Flood and stormwater runoff management Improved water supply reliability Improved water quality Reduced energy use	Changes in streamflow Increased energy use Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Reduced flooding Reduced energy use	Changes in streamflow Increased energy use
Water Transfers	Improved water supply reliability Reduced groundwater overdraft/subsidence Improved groundwater quality resulting from reduced saline intrusion from the San Joaquin River Increased instream flows Increase available storage	Reduced carryover storage	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion Increased instream flows Increase available storage	Reduced carryover storage
Increase Water Supply				

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	Potential Impacts	Potential Benefits	Potential Impacts
Conjunctive Management and Groundwater Storage	Improved water supply reliability Reduced groundwater overdraft/subsidence, including reduced threat of flooding from levee subsidence Improved water use efficiency Improved water quality	Degraded water quality during pumping periods	Improved water supply reliability Reduced subsidence, including reduced threat of flooding from levee subsidence	Reduced water availability and reliability (competition over interregional supplies) Reduced instream flows Degraded water quality
Municipal Recycled Water	Reduced groundwater overdraft/subsidence Improved water supply reliability (including offset of potable water use) Decreased operational costs (through reduced fertilizer requirements) Improved groundwater quality resulting from reduced saline intrusion	Increased salt/nutrient loading Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife Growth inducement	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	Increased salt/nutrient loading
Surface Storage - CALFED	Reduced groundwater overdraft/subsidence Reduced Flooding Improved water supply reliability Improved coordination of land use and water resources planning Improved water quality	Reduced instream flows Construction related impacts, including temporary impacts, and long-term disturbance of habitat and wildlife Growth inducement	Reduced flooding	Reduced instream flows Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife, and loss of habitat
Surface Storage- Regional/Local	Reduced groundwater overdraft/subsidence Reduced flooding Improved water supply reliability Improved coordination of land use and water resources planning Improved water quality	Reduced instream flows Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife, and loss of habitat Growth inducement	Reduced flooding	Reduced instream flows Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife, and loss of habitat
Improve Water Quality				
Drinking Water Treatment and Distribution	Improved water supply reliability Improved water quality Public health benefits	Reduced instream flows Increased energy use Growth inducement Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife, and loss of habitat	Improved water supply reliability (reduced demand on interregional supplies)	Reduced water supply reliability (increased use of interregional supplies) Increased energy use Construction related impacts, including disturbance of habitat and wildlife
Groundwater Remediation/Aquifer Remediation	Reduced groundwater overdraft/subsidence Improved water supply reliability Improved water quality	Increased groundwater pumping/subsidence Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Improved water supply reliability (reduced demand on interregional supplies)	Increased groundwater pumping/subsidence
Matching Quality to Use	Improved water supply reliability	Reduction in delivered water quality	Improved water supply reliability (reduced demand on interregional supplies)	None
Pollution Prevention	Improved water quality Improved habitat Decreased treatment costs Improved experience for water dependent recreation Improved coordination of land use and water resources planning	None	Improved water quality Improved habitat Improved experience for water dependent recreation	None

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	Potential Impacts	Potential Benefits	Potential Impacts
Salt and Salinity Management	Improved water quality Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	None	Improved water supply reliability (reduced demand on interregional supplies) Improved groundwater quality resulting from reduced saline intrusion	None
Urban Stormwater Runoff Management	Improved water supply reliability Improved water quality Improved habitat Decreased treatment costs Improved coordination of land use and water resources planning	Land use restrictions	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	None
Improve Flood Management				
Flood Management	Reduced flooding Increased aquifer recharge Improved water quality Reduced risk to life and property Decreased flood insurance costs Improved water supply reliability Reduced saline intrusion Improved coordination of land use and water resources planning	Loss of revenue from restricted land use Loss of flows to downstream water users Increased sedimentation and erosion Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife and loss of riparian and/or wetland acreage	Reduced flooding Improved surface water quality Reduced risk to life and property Decreased flood insurance costs Improved water supply reliability Reduced saline intrusion	Loss of flows to downstream water users Increased sedimentation and erosion Increased flood flows to downstream communities Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife and loss of riparian and/or wetland acreage
Practice Resources Stewardship				
Agricultural Lands Stewardship	Local prosperity (decreased operational costs and improved agricultural productivity) Improved water quality Improved coordination of land use and water resources planning Improved habitat Open space preservation Flood control and stormwater runoff management Improved water supply reliability	Land use restrictions (prevention of future urbanization)	Open space preservation Improved water supply reliability Improved water quality	None
Ecosystem Restoration	Improved coordination of land use and water resources planning Improved habitat and wildlife passage Improved water quality Increased numbers of native species Increased recreational opportunities including recreational viewing Open space preservation	Land use restrictions Economic impacts (loss of revenue from restricted land use) Construction related impacts	Improved habitat and wildlife passage Improved water quality Open space preservation (protection of some of the most ecologically sensitive areas in Merced County)	None
Forest Management	Improved water supply reliability (through protection of snowpack) Improved water quality Improved habitat and wildlife passage Improved coordination of land use and water resources planning	Land use restrictions	Improved supply reliability Improved water quality	Land use restrictions

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	Potential Impacts	Potential Benefits	Potential Impacts
Land Use Planning and Management	Minimize unintended impacts resulting from land use planning that is not coordinated with water resources planning Improved flood and stormwater runoff management Improved water supply reliability (including increased groundwater recharge) Improved water quality Improved water recreation activities	Land use restrictions Growth inducement	Improved supply reliability	None
Recharge Area Protection	Improved water quality Increased groundwater recharged/reduced subsidence Improved supply reliability	Land use restrictions	Improved water supply reliability (reduced demand on interregional supplies) Improved supply reliability	None
Sediment Management	Flood and stormwater runoff management Improved water quality Improved natural resources	Land use restrictions	Flood and stormwater runoff management Improved water quality Improve natural resources	Land use restrictions
Watershed Management	Reduced flooding Improved water supply reliability Improved water quality Improved habitat and wildlife passage Improved local understanding of water resources issues Improved coordination among water resource stakeholders Enhanced water-associated recreational activities	Land use restrictions Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Reduced flooding Improved water supply reliability Improved water quality Improved habitat and wildlife passage Improved coordination among water resource stakeholders	Land use restrictions
People and Water				
Economic Incentives (Loans, Grants and Water Pricing)	Improved water supply reliability Improved water use efficiency Local prosperity (decreased operational costs) Improved groundwater quality resulting from reduced saline intrusion Improved coordination among water resource stakeholders	Economic impacts (either for the agency sponsoring loans and grants or customers affected by water pricing)	Improved water supply reliability (reduced demand on interregional supplies) Improved groundwater quality resulting from reduced saline intrusion	Economic impacts (loss of revenue)
Outreach and Engagement	Enhanced public understanding of water management issues and needs	None	Enhance public understanding of water management issues and needs	None
Water and Culture	Enhanced public understanding of water management issues and needs	None	Enhance public understanding of water management issues and needs	None
Water-Dependent Recreation	Increased recreational opportunities for the Region Enhanced public safety Local prosperity	Degraded water quality (through increased erosion and sedimentation) Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Degraded water quality	Degraded water quality (through increased erosion and sedimentation)
Other Strategies				
Crop Idling for Water Transfers	Improved water supply reliability Improved coordination of land use and water resources planning Improved water use efficiency	Economic impacts (loss of revenue)	Improved water supply reliability (reduced demand on interregional supplies)	None

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	Potential Impacts	Potential Benefits	Potential Impacts
Irrigated Land Retirement	Improved water supply reliability Improved coordination of land use and water resources planning Improved water use efficiency	Economic impacts (loss of revenue) Loss of habitat and open space (through conversion to urban uses)	Improved water supply reliability (reduced demand on interregional supplies)	None
Rainfed Agriculture	Reduced groundwater overdraft/subsidence Improved water supply reliability Decreased operational costs	Economic impacts (loss of revenue through reduced productivity)	Improved water supply reliability (reduced demand on interregional supplies)	None

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Chapter 8 Plan Performance and Monitoring

This chapter addresses the IRWM Plan Performance and Monitoring Plan Standard which requires IRWM Plans to:

- ✓ Contain performance measures and monitoring methods to ensure the objectives of the Plan are met
- ✓ Describe a method for evaluating and monitoring the ability of the RWMG to meet the objectives and implement the projects in the Plan
- ✓ Ensure each project in the Plan is monitored to comply with all applicable rules, laws, and permit requirements
- ✓ Contain policies and procedures that promote adaptive management and, as more effects of Climate Change manifest, new tools are developed, and new information becomes available, adjust IRWM Plans accordingly

This chapter describes the general process MIRWMA will use to track plan performance and monitor project implementation. MIRWMA will periodically verify the Region is implementing projects listed in the MIRWMP and efficiently making progress towards meeting MIRWMP objectives, and each implemented project is monitored to comply with all applicable rules, laws, and permit requirements.

8.1 Plan Performance Review

Plan Performance Reviews will be conducted at regular intervals by MIRWMA, with support by the RAC or a designated workgroup. The first Plan Performance Review will occur three years after the adoption of the updated MIRWMP and will evaluate progress made toward achieving Plan objectives and implementing the projects listed in the Plan. Subsequent reviews will be conducted in five-year intervals starting from completion of the first review.

Two tables will be generated with each Plan Performance Review: one that addresses the extent to which the MIRWMP objectives have been met, and one that describes progress made in implementing the projects listed in the MIRWMP. The first table, which will be entitled “Progress Toward Achieving Plan Objectives”, will report the aggregate of the performance measure data collected and submitted by the reporting agencies for each of the MIRWMP objectives listed in Chapter 4 Objectives. The second table, which will be entitled “Status of Project Implementation”, will detail project proponent, implementation status, and funding source(s) for each priority (Tier 1) project within the online project database. Projects that have been fully implemented will be highlighted separately.

Templates of these tables are provided on the following pages.

Table 8-1: Example Reporting Template: Progress toward Achieving Plan Objectives

Objective	Performance Measures	Monitoring/Reporting Result	Cumulative Progress To-Date
A. Correct groundwater overdraft conditions.	1. Groundwater surface elevation 2. Volume of water recharged 3. Reduction in groundwater subsidence 4. Improvement in groundwater quality		
B. Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management.	1. Occurrence of flooding at the Bear Creek, Black Rascal Creek diversion, Deadman Creek, Dry Creek, Fahrens Creek, Lake Yosemite, Mariposa Creek, Merced River, and San Joaquin River 2. Volume of flood water stored and / or recharged 3. Flood-related damages (extent and frequency)		
C. Meet demands for all uses, including agriculture, urban, and environmental resource needs.	1. Curtailment of voluntary and/or mandatory water use restrictions 2. Stability of groundwater levels 3. Ability to meet instream flow requirements		
D. Improve coordination of land use and water resources planning.	1. Number of cooperative planning meetings held between land use and water resource planning entities 2. Number of General Plans with water resource elements		
E. Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure.	1. Number of projects implemented that address climate change		
F. Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible.	1. Estimated annual savings from demand management programs 2. Volume of water per year put to beneficial reuse 3. Percent of water users with meters and commodity pricing 4. Urban per capita water use (in accordance with provisions of SBx7-7)		

Objective	Performance Measures	Monitoring/Reporting Result	Cumulative Progress To-Date
G. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	1. New 303(d) listings and / or delistings 2. Surface water and groundwater quality		
H. Protect, restore, and improve natural resources.	1. Acres of habitat protection / restoration / enhancement completed 2. Development trends in the largest and most ecologically sensitive areas of Merced County (including the Merced and San Joaquin River corridors and Eastside Grasslands)		
I. Address water-related needs of disadvantaged communities (DACs).	1. Programs implemented that focus on meeting critical water-related needs of DACs 2. Percent of population with drinking water that complies with all applicable standards		
J. Protect and enhance water-associated recreation opportunities.	1. Number of programs that include water-associated recreation opportunities		
K. Establish and maintain effective communication among water resource stakeholders in the Region.	1. Number of stakeholders or their representatives and members of the public attending IRWM-related meetings 2. Number of collaborative projects jointly implemented by multiple entities		
L. Enhance public understanding of water management issues and needs.	1. Number of educational programs / number of people participating in water-focused educational events in the Region		

Table 8-2: Example Reporting Template: Status of Project Implementation

Project	Proponent	Status of Project Implementation	Secured Funding Sources
Bear Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, and Merced Irrigation District)		
Le Grand CSD Water Meter Conservation Project	Le Grand CSD		
Cressey Recharge Basin Expansion	MID		
Water Education and Public Information	City of Merced		

8.2 Project-Specific Data Collection and Monitoring Plans

Project proponents will be required to develop project-specific monitoring plans prior to, or in conjunction with, project implementation. Project proponents will be responsible for performing the monitoring activities, collecting and validating that the data are consistent with MIRWMP requirements, and submitting the data to relevant state and federal databases as appropriate (refer to Chapter 9, Data Management). For projects that receive funding for project implementation through the IRWM Program, each project proponent will be required to prepare a project-specific monitoring plan consistent with the requirements outlined in this Plan and the grant agreement. The project proponents must also ensure the project monitoring plan is being implemented accordingly. Each monitoring plan will include an estimated timeline of monitoring activities which MIRWMA will use as a guideline for overall program implementation. Data collected and analyses performed for DWR grant-funded projects will be reported to appropriate state and federal databases, along with required documentation and an evaluation of project performance. Post-Performance Reports documenting the project's ability to meet its anticipated benefits will also be prepared on an annual basis for 10 years following project operation, if required by the grant agreement. This will help ensure implemented projects fulfill MIRWMP objectives as originally intended.

Project-specific monitoring plan requirements and data collected will vary based on the type of project being implemented and required state and federal monitoring guidelines. These requirements may include:

- Projects that involve surface water quality must meet the criteria for and be compatible with the SWRCB Surface Water Ambient Monitoring Program (SWAMP), http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml.
- All projects that involve groundwater quality must meet the criteria for and be compatible with the SWRCB Groundwater Ambient Monitoring and Assessment (GAMA) program, http://www.waterboards.ca.gov/gama/.
- Projects collecting groundwater elevation should be compatible with the needs of the CASGEM program, https://water.ca.gov/Programs/Groundwater-Management/Groundwater-Elevation-Monitoring--CASGEM
- All projects that involve wetland restoration must meet the criteria for and be compatible with the State Wetland and Riparian Area Monitoring Plan (WRAMP), https://mywaterquality.ca.gov/monitoring_council/wetland_workgroup/docs/2010/tenetsprogram.pdf

Based on recent grant agreements for IRWM implementation grants, it is anticipated that IRWM grant funded project's monitoring plans would include the following:

- A table describing what is being monitored for the project (e.g. water quality, water depth, flood frequency), and effects the project may have on habitat or particular species (before and after construction).
- Measures to remedy or react to problems encountered during monitoring that may have resulted from project construction or implementation.
- Location of monitoring.
- Monitoring frequency.
- Monitoring protocols/methodologies and quality assurance and quality control (QA/QC) procedures, including who will perform the monitoring.
- A description of how those monitoring protocols / methodologies and QA/QC procedures are consistent with requirements for applicable statewide databases including CASGEM, SWAMP, GAMA, and WRAMP.
- Procedures and a schedule for incorporating collected data into statewide database(s).
- Procedures and a schedule for reporting to MIRWMA confirmation of data submittal to appropriate statewide database(s).
- Procedures to ensure the monitoring schedule is maintained and that adequate funding is available to maintain monitoring of the project throughout the scheduled monitoring timeframe.

Project proponents should keep the MIRWMP objectives the project is intended to address in mind when developing monitoring plans. Each Plan objective (see Chapter 4, Objectives) provides measurable targets designed to assess each submitted project's contribution to the MIRWMP objectives as established by the Region's stakeholders. Monitoring each project's contribution to the MIRWMP objectives can assist with assessing the MIRWMP's overall progress towards achieving the regional objectives.

Project proponents will be solely responsible for completing data collection in accordance with the approved project-specific monitoring plan, which will clearly identify monitoring and analytical techniques, QA/QC procedures to be implemented, and will describe how those techniques are compatible with the requirements of appropriate federal and statewide database(s).

Project proponents will also be responsible for reviewing the data collection and QA/QC protocols to validate that data were collected in accordance with the required procedures, and "spot-checking" all data for accuracy at the time of entry to the database to identify any apparent errors. Once data collection and QA/QC has been completed, project proponents will submit the compatible data to appropriate federal and statewide database(s).

8.3 Adaptive Management

The Plan Performance Review process will include an adaptive management component which will allow MIRWMA to respond to lessons learned from analyzing collected performance measure and project monitoring data. Adaptive management also allows the Region to more quickly mitigate the effects of climate change as new tools and information become available. With this information, MIRWMA, in coordination with the RAC, may consider modifying Plan objectives, performance measures, the applicability of selected resource management strategies, and the project review and prioritization process. This proactive approach will improve MIRWMA's ability to determine the type of projects to select and implement in the future.

Local agencies implementing MIRWMP projects will monitor for specified parameters to determine how well each project is fulfilling its objectives. This information will be fed back into the project's decision-making structure to adapt the project to better meet its overall objectives. Only by consistent monitoring and analysis can projects successfully achieve their objectives. 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. When the MIRWMP is updated in the future and regional objectives are revisited, the RAC will discuss and evaluate the status of MIRWMP implementation. The results of project-specific monitoring efforts will be used to identify areas where Plan implementation may need to be modified to best achieve Plan objectives moving forward.

When projects included in the MIRWMP are implemented independently from the MIRWMP program (i.e., without IRWM grant funding), project proponents, while not required, will be encouraged to prepare and administer project-specific monitoring plans that are generally consistent with the monitoring plans described above. During the Plan Performance Review, MIRWMA will assess the extent to which the MIRWMP objectives have been met based on the projects and programs completed throughout the Region. In this way, progress made toward achieving Plan objectives by projects implemented outside of the IRWM Program will be assimilated into the Plan Performance Review.

Merced Integrated Regional Water Management Plan

Chapter 9 Data Management

This chapter addresses the IRWM Plan Data Management Plan Standard which requires IRWM Plans to:

✓ Describe the process of data collection, storage and dissemination to IRWM participants, stakeholders, the public and the State

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This chapter describes the process used by project proponents to ensure efficient use of, access to, and integration of available data generated by IRWM implementation activities into existing State and federal databases.

MIRWMA and the RAC have developed standard data and information management practices to be followed for projects and programs implemented as part of the MIRWMP to establish a common protocol for data collection, validation, and sharing throughout the Region. Projects and programs implemented outside of the IRWM Program (i.e., without IRWM grant funding) are encouraged to follow similar protocols to maximize usefulness and compatibility of data collected throughout the Region, and to improve potential integration into relevant federal and statewide databases. Anticipated data collected and reporting procedures are presented in the sections below. For the purposes of this plan, the term data includes technical documentation (such as designs, feasibility studies, and reports), as well as technical information collected as part of project or program planning, design, implementation, and operation.

9.1 Overview of Data Needs and DMSs

In the past, various local, state and federal agencies and non-governmental organizations collected valuable water-related data throughout the Merced Region, but not in a uniform or collaborative manner. At times, data were collected for a specific project, were not shared, and offered limited region-wide usefulness. The 2013 MIRWMP identified regional data needs and established standard protocols to help improve collaboration among the Region's agencies, organizations, project proponents, and stakeholders and to more efficiently understand water quality and environmental conditions.

The Merced online project database was developed during preparation of the 2013 MIRWMP as a tool for locating, connecting, sharing and integrating projects within the Region, and promoting collaboration among project proponents and the public. The online project database continues to be used for Merced IRWMP project solicitation and project sharing, as well as Merced SWRP project solicitation. Any interested member of the public can register as community members in the database to view basic information and collaborate on projects. The site includes space for collaborators to share notes and documents related to their projects, and the project proponent has the option to make these items visible for public users interested in following the project progress.

The Merced Hydrologic Data Management System (Merced HydroDMS) was also developed during preparation of the 2013 IRWMP to serve as the centralized data management system (DMS) for project proponents within the Merced Region. The system included data entry forms for users to submit data and tools to automate report and chart preparation based on available data. This collaboration was to be used to identify and fill data gaps, document the status of current water resources problems, detect new problems, and provide information to the Region to track MIRWMP implementation progress. The Merced HydroDMS is undergoing a transition, including an update to a new platform, as part of the Merced GSP planning process. The upgraded DMS, known as Merced GSP Opti DMS, expanded upon the HydroDMS both on functionality and data. GSP development is still underway and thus, data are still being collected and reviewed, and data gaps are continuing to be identified. Future planning efforts will determine how the Opti DMS may be utilized to support MIRWMP implementation.

Review of existing water management plans, RAC discussions, and public input identified specific data needs within the Merced Region. These needs include:

- Up-to-date, spatially-referenced land use data that includes recent agriculture-to-agriculture conversions that impact water demands in the Region
- Groundwater data to assess current groundwater conditions and to determine necessary management activities
- Local groundwater water quality data to determine the suitability of recharge areas

Implementation of the MIRWMP will assist in meeting these data needs. Identified data gaps will be addressed through project implementation and may be filled through parallel efforts such as the Merced SGMA process and SWRP and GSP implementation. In some cases, these gaps may be filled by projects specifically designed to collect needed data, and in other cases, data gaps may be addressed indirectly through data reported in project performance monitoring plans.

9.2 Data Collection Techniques

9.2.1 Data Collection

Standard procedures need to be established for routine data collection and management within the Merced Region to improve regional data availability and efficiency. These include:

- Standard data collection and record-keeping to improve collaboration and promote more usable data by organizations across the region.
- Uniform data management protocols for MIRWMP projects to allow broader sharing and comparability.
- Use of a centralized DMS to efficiently address regional questions about the condition of water resources in the Region.
- Dissemination of data to the public in a format that improves public understanding of water management issues.

Data collected in conjunction with MIRWMP implementation projects will vary based on the type and scope of each individual project, but may include:

- streamflow
- surface water deliveries
- groundwater elevations
- groundwater pumping
- precipitation
- volume of water impounded or recharged
- water demand
- locations and sizes of water-related facilities
- political and agency boundaries
- land use
- contaminant plume location and extent
- water quality data
- locations of sensitive habitats and species
- hydrogeologic and hydrologic data
- visitor days at recreational areas
- community members served by educational events

Project proponents may also develop data through numerical tools, such as hydrologic models. Working with the project proponents, agencies, regional stakeholders, MIRWMA, and the RAC will continue to seek out data needed to address regional data gaps on an ongoing basis (Table 9-1). Identified data gaps will be filled as new data sources and/or monitoring activities are identified.

Table 9-1: Potential Sources of Water Resources Data

Federal	State	Local
National Climatic Data Center National Resource Conservation District Army Corps of Engineers U.S. Bureau of Reclamation U.S. Fish & Wildlife Service U.S. Geologic Survey National Marine Fisheries Service U.S. Environmental Protection Agency The Nature Conservancy U.S. Forest Service	California Irrigation Management Information System (CIMIS) Department of Fish & Wildlife Department of Public Health Department of Water Resources State Water Resources Control Board & the Regional Water Quality Control Board California Natural Diversity Database California Department of Pesticide Regulation California Data Exchange Center (CDEC)	City Planning Departments East Merced Resource Conservation District Merced County Association of Governments Merced Area Groundwater Pool Interests Merced County Merced Irrigation District Merced Streams Group University of California, Merced Stakeholders Water and Wastewater Districts

As detailed in Section 8.2, MIRWMP project proponents will be required to prepare project-specific monitoring plans that identify how monitoring and analytical techniques and QA/QC procedures are compatible with the requirements of relevant federal and statewide database(s). In general, state databases have specific requirements for data submittal (format and procedural) that will need to be followed. Geospatial data maintained and submitted by project proponents should be accompanied by applicable metadata that describes each dataset, including projection and datum information, dataset description, and data lineage. Relevant databases include those summarized below.

California Environmental Data Exchange Network (CEDEN)

CEDEN is a central system designed to find and share information about California's water bodies, including streams, lakes, rivers, and the coastal ocean. CEDEN aggregates water quality, aquatic habitat, and wildlife health data collected by groups throughout California and makes it accessible to environmental managers and the public. The CEDEN data templates are available on the CEDEN website: http://www.ceden.org/

Water Data Library

DWR maintains the State's Water Data Library, which stores data from various monitoring stations, including groundwater level wells, water quality stations, surface water stage and flow sites, rainfall/climate observers, and well logs. Information regarding the Water Data Library can be found at: http://wdl.water.ca.gov/

California Data Exchange Center (CDEC)

DWR maintains the California Data Exchange Center (CDEC), which installs, maintains, and operates an extensive data collection network including automatic snow reporting gages and precipitation and river stage sensors for flood forecasting.

California Statewide Groundwater Elevation Monitoring (CASGEM)

Projects collecting groundwater elevation data should be compatible with the needs of the CASGEM program. As the designated Monitoring Entity for the Merced Groundwater Subbasin, MAGPI is the entity responsible for providing regular and systematic monitoring of groundwater elevations to DWR. To support MAGPI's efforts, project-collected groundwater elevation data must provide well identification number, measurement date, reference point and land surface elevation, depth to water, method of measuring water depth and measurement quality codes. Additional information on the CASGEM program is available at: https://water.ca.gov/Programs/Groundwater-Management/Groundwater-Elevation-Monitoring--CASGEM

Surface Water Ambient Monitoring Program (SWAMP)

Projects collecting surface water data will be required to adhere to SWAMP data collection protocols. Typical data collection techniques for surface waters include both field measurements and laboratory analysis. Field measurements are either collected using meters or field kits for a common list of constituents including but not limited to: water temperature, pH, conductivity, dissolved oxygen and turbidity. Links to examples of field data sheets and samples are as follows:

- Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California:
    - https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/collect_bed_sediment_update.pdf
- Sample field sheets:
    - https://pubapps.waterboards.ca.gov/centralvalley/water_issues/swamp/r5_activities/s2s_08_att4.pdf
    - https://drive.google.com/file/d/1M29jFW0OZ-L-wwjU_RJNZD94XQ2gr2sc/view

There are many possible constituents measured in surface waters that require laboratory analysis, most commonly fecal indicator bacteria, metals, nutrients, persistent organic pollutants, and turbidity. SWAMP provides guidance on methods and quality assurance, which can be found at: https://www.waterboards.ca.gov/water_issues/programs/swamp/qapp/swamp_QAPrP_2017_Final.pdf

Biological monitoring is helpful for determining the health of a system and whether it can sustain a diverse community of benthic macro invertebrates. Standard operating procedures for determining a stream's physical/habitat condition and benthic invertebrate assemblages can be found at:

- Standard Operating Procedures for the collection of field data for bioassessments of California wadeable streams (benthic microinvertebrates, algae, and physical habitat): https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/docs/combined_sop_2016.pdf
- Supplemental guidance for the SWAMP bioassessment field protocol: https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/docs/guidance_doc_v4_0516.pdf

Groundwater Ambient Monitoring and Assessment program (GAMA)

Projects collecting groundwater data will be required to adhere to GAMA data collection protocols. The GAMA Priority Basin Project is grouped into 35 groundwater basin groups called "study units." Each study unit is sampled for common contaminants regulated by CDPH and for unregulated chemicals. Testing for these chemicals, usually at detection levels well below those achieved by most laboratories, will help public and private groundwater users to manage this resource. Results from the Central Eastside San Joaquin study unit, which includes the Merced Region, can be found at http://www.waterboards.ca.gov/gama/. Some of the chemical constituents that are sampled by the GAMA Priority Basin Project include:

- Low-level VOCs
- Low-level pesticides
- Stable isotopes of oxygen, hydrogen, and carbon
- Emerging contaminants (pharmaceuticals, perchlorate, hexavalent chromium, and other chemicals)
- Trace metals (arsenic, selenium, lead, and other metals)
- Radon, radium, and gross alpha/beta radioactivity
- General ions (calcium, magnesium, fluoride)
- Nutrients, including nitrate, and phosphates
- Bacteria: total and fecal coliform bacteria

Wetland and Riparian Area Monitoring Program (WRAMP)

Projects involving wetland restoration must meet the criteria for and be compatible with WRAMP. WRAMP is intended to track trends in wetland extent and condition to determine the performance of wetland, stream, and riparian protection programs in California. The program defines standardized assessment methods and data management with the goal of minimizing new costs and maximizing public access to assessment information. Additional information on the WRAMP program is available at: https://mywaterquality.ca.gov/monitoring_council/wetland_workgroup/docs/2010/tenetsprogram.pdf

9.2.2 Quality Assurance/Quality Control Measures

As described in Section 8.2, individual project proponents will be responsible for reviewing data collection and quality assurance/quality control (QA/QC) protocols to validate that data were collected in accordance with QA/QC procedures required as part of the project monitoring program. In addition, project proponents will be responsible for "spot-checking" all data for accuracy at the time of entry to the database to identify any apparent errors. Once data collection and QA/QC has been completed in accordance with provisions of the approved project-specific monitoring plan, the project proponent will submit the compatible data to the appropriate federal or statewide database.

9.3 Data Sharing

MIRWMA, the RAC, project proponents, and other IRWM planning participants are all jointly responsible for data dissemination. During MIRWMP development, data were disseminated via public workshops, RAC meetings, the MIRWMP website and database postings. During implementation, the Merced online project database may be used to share project information and data collected as part of MIRWMP. The Merced GSP Opti DMS may also be used to share project information and data collected as it continues to be developed and integrated in the future.

Individuals without internet access may contact one of MIRWMA's member agencies to request hard copies of specific datasets. Project proponents will also be required to submit data to the statewide database(s) specified in the approved project-specific monitoring plan.

Environmental documentation processes (i.e. CEQA and NEPA) are another method of disseminating data for review by interested stakeholders and the public. Completion of environmental documentation will be the sole responsibility of project proponents and will be completed on a project-by-project basis.

This chapter addresses the IRWM Finance Plan Standard which requires IRWM Plans to:

- ✓ List known, as well as, possible funding sources, programs and grant opportunities for the development and ongoing funding of the IRWM Plan
- ✓ List the funding mechanisms, including water enterprise funds, rate structures, and private financing options, for projects that implement the IRWM Plan
- ✓ Explain the certainty and longevity of known or potential funding for the IRWM Plan and projects the implement the Plan
- ✓ Explain how operation and maintenance (O&M) costs for projects that implement the IRWM Plan would be covered and the certainty of operation and maintenance funding

10.1 Funding Sources and Mechanisms for Planning and Implementation

As with many IRWM regions in California, project funding continues to be a major obstacle for MIRWMP and project implementation. Demands on limited local funds continue to increase, construction costs continue to rise, and existing infrastructure requires maintenance or upgrades to meet growing demands. In this economic climate, agencies are challenged to balance the benefits and costs of establishing high water quality and supply reliability versus protecting and enhancing the environment. Further, projects that benefit the environment but do not provide new water or a measurable improvement to water supply reliability and/or water quality are typically dependent upon public assistance for implementation. Funding is particularly difficult for the Merced Region due to the economic distress of its communities. The poverty rate in Merced County was 23.8% in 2017 (Unites States Census Bureau, 2018b), and the California Employment Development Department reported multiple communities within the Merced Region having unemployment rates greater than 10% in 2018 (CA EDD, 2018). Given the Region's economic conditions, MIRWMA and project proponents are conscious of the need to implement MIRWMP projects and programs in a cost-effective manner.

The 2018 MIRWMP update was developed with funding from the MIRWMA member agencies: MID, County of Merced, and Cities of Merced, Atwater, and Livingston. MIRWMA is committed to maintaining an implementable IRWM Plan and recognizes the majority of MIRWMP maintenance must come through funding by its member agencies. MIRWMA's member agencies intend to implement periodic plan performance reviews, continue coordinating and participating in meetings of the RAC, organize stakeholder outreach efforts, and update the MIRWMP as needed to ensure it addresses current conditions and issues. MIRWMA plans to commit staff time to organize and attend RAC meetings (distributed among the staff of MIRWMA member agencies) and organize and attend MIRWMA Board meetings (distributed among elected officials and staff members), as discussed in Chapter 3 Governance.

The estimated costs of individual projects included in the MIRWMP range from tens of thousands of dollars to multi-million dollars, totaling approximately $168 million as of August 31, 2018 (Appendix D[1]). Of this

1 The project list provided in this Plan reflects the project list developed during the project solicitation period conducted from July 9, 2018 through August 31, 2018. The project list contained in the Merced online project database is a living project list and represents the current MIRWMP project list; the project list provided in this Plan reflects the project list as of September 2018.

amount only $2 million, or 1.2% of the total estimated costs, have been secured by project proponents through local funding sources and existing grants (Appendix D). As most project proponents have not secured local funding, many MIRWMP projects were submitted with the hope of securing outside funding for proposed implementation.

MIRWMA, the RAC, and regional stakeholders understand that while long-term project and program costs (e.g., operation and maintenance costs) must be funded primarily by local entities, outside funding provides critical revenue to move projects from planning to construction. While grants and loans represent unsecured sources of funding, there is significant uncertainty in local sources in a region whose rate base is primarily DACs and where some water and sewer enterprise funds have been running at a deficit. Inadequate funding has prevented "shovel-ready" projects from being completed and projects designed to meet critical regional water management needs from moving beyond the planning phases. MIRWMA will fund oversight of the MIRWMP through in-kind time and limited material commitments, but outside sources of funding will be needed to supplement locally available funds and advance critical projects.

It should be recognized that each implementing organization has a unique set of revenue and financing methods and sources. This MIRWMP does not provide an exhaustive list of funding sources available. Many of the same funding sources and/or mechanisms would be used for continued development of the MIRWMP and for project/program implementation. Potential funding sources for furthering the MIRWMP and implementing projects are listed in Table 10-1, and the funding mechanisms are further described below.

Table 10-1: Funding Sources for Development of the MIRWMP and Implementation of Projects

Funding Mechanisms	Continued IRWM Plan	Project / Program Implementation	Certainty & Longevity of Funding
User Rates / Recovery		✓	Dependent upon rate structure adopted by project proponents
Capacity Fees		✓	Dependent upon rate structure adopted by project proponents
User Fees		✓	Dependent upon rate structure adopted by project proponents
Special Assessments		✓	Dependent upon the ability to demonstrate direct and unique benefits to parcels. Once in place this represents high certainty of funding.
General or Capital Improvement Funds	✓	✓	Dependent upon budgets adopted by project proponents and participating agencies
Revenue Bonds		✓	Dependent upon debt carried by project proponents & bond market
Local, State, or Federal Grant Programs	✓	✓	Dependent upon future local, state, and federal budgets, and success in application process

Funding Mechanisms	Continued IRWM Plan	Project / Program Implementation	Certainty & Longevity of Funding
Low-interest Loan Programs		✓	Dependent upon future local, state, and federal budgets, and success in application process

- **User Rates/Rate Recovery**. User rates or rate recovery pays for the operation and maintenance of a water agency or public utility system. Each month a water agency customer pays a water bill that consists of two components: a monthly fixed rate, calculated to cover the base function of the system (labor and overhead expenses), and a variable rate based on the metered usage. This variable cost fluctuates relative to the amount of pumping and treatment needed to meet customer demands throughout the system (electrical and chemical costs). In some cases, a water agency will design the variable rate to be contingent on an estimated monthly water use allowance, meaning the variable rate is charged only if the customer's usage exceeds this fixed allowance. In tiered water rates, the variable fee increases with water consumption. For services without meters, a single monthly rate is assessed based on assumed consumption and may include additional miscellaneous fees, such as a surcharge for swimming pools.

  Regional stakeholders understand the need to fully vet projects before increasing their water and wastewater rates and have emphasized that projects designed to address existing water management must be economically sustainable given the current population/ratepayers. As such, the certainty of funding for projects which propose rate increases will be largely dependent on the support garnered for the project and ratepayers understanding of the project need.

- **Capacity Fees**. Capacity fees are charged to users who create new or additional demand on water or wastewater systems to achieve and maintain equity among past, present and future customers. These fees are typically charged per connection, measured in equivalent dwelling units. A single connection may encompass more than one equivalent dwelling unit.

  California law requires that these charges comply with the Mitigation Act (AB1600, Government Code 66000 *et seq*.) which states nexus must be established between the connection and costs, and that fees should be proportionate to the cost of providing service.

- **User Fees**. Monthly user fees are assessed by water agencies when facilities are implemented that directly benefit existing customers. This is particularly true for water agencies that are developing conjunctive use water systems in which existing customers may have paid for the groundwater component when they paid the development fee (through the purchase of the home). The surface water and/or recycled water component is a new water supply for a water agency that is needed for conjunctive use with groundwater supplies. Income from this monthly revenue source may be used to pay debt service on debt financed assets.

- **Special Assessments**. Upon compliance with Proposition 218, a government agency can impose a special assessment on properties that receive a special benefit from the public project that is being constructed.

  As the Region works to address critical flood management needs, it may be necessary to form a Flood Control District or a JPA (comprised of agencies with authority over flood management) to create drainage areas, flood control zones and other special assessment areas to support design, construction and maintenance of flood and stormwater management facilities. Within the Merced

Region, a Flood Control District would absorb all functions currently performed by the Merced Streams Group.

An assessment district for maintaining the groundwater basin, such as the districts authorized under AB3030, could be created and properties could be assessed to support groundwater recharge projects and monetary cost of purchased recharge water.

- **General or Capital Improvement Funds**. General or capital improvement funds are raised and set aside by an agency to fund general operations and/or facility development, improvements, and upgrades. These funds are usually part of the overall revenue stream and may or may not be project-specific.
- **Revenue Bonds**. Revenue bonds may be issued to raise necessary capital in cases where large facilities are needed to support current services and future growth. This allows large facility construction to be paid for by bonded debt service with repayment over a 20- to 30-year timeframe. Issuing revenue bonds is a preferred approach for financing 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 drawback to bonded debt however 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 case development fees are not adequate to make the required annual payment for the debt service
- **Local, State, and Federal Grant Programs.** Grant programs typically require a local matching requirement to establish a commitment to promoting and completing the study or project. Grants also typically carry high administration costs due to extensive reporting requirements, and in most cases, only a small portion of the grant may be used to cover these expenses. Grant programs that Regional project proponents may consider for the future project funding include:
    - California State Parks Office of Grants and Local Service Annual Grant Programs
        - Land and Water Conservation Fund
        - Recreational Trails Program
    - Community Alliance with Family Farms
    - Department of Water Resources
        - IRWM Grant Program
        - Sustainable Groundwater Planning Grant Program
        - Water Desalination Grant Program
        - Central Valley Tributaries Program
    - SWRCB Programs
        - 319(h) Nonpoint Source Grant Program – Timber Regulation & Forest Restoration Funds
        - Orphan Site Cleanup Fund
        - Site Cleanup Subaccount Program
        - CAA Emergency Drinking Water Program
        - Drinking Water for Schools Grant Program
        - Water Recycling Funding Program
    - SWRCB Storm Water Management Grant Program
        - Groundwater Sustainability Funding Program
    - The Nature Conservancy
    - U.S. Bureau of Reclamation
        - WaterSMART Program
            - Water and Energy Efficiency Grants

                - Small-Scale Water Efficiency Grants
                - Water Marketing Strategy Grants
                - Cooperative Watershed Management Program Grants
                - Drought Program Grants
            - Title XVI Water Reclamation and Reuse Program (including the Water Infrastructure Improvements for the Nation (WIIN) Subset)
        - U.S. Department of Agriculture
            - Rural Development Grant Assistance
            - Conservation Service Financial Assistance Program
                - Agricultural Management Assistance
                - Conservation Stewardship Program
                - Environmental Quality Incentives Program
        - U.S. Economic Development Administration Investment Programs
        - U.S. Environmental Protection Agency
            - Environmental Justice Grants and Cooperative Agreements
        - U.S. Fish & Wildlife Grant Program
            - North American Wetlands Conservation Act
        - Proposition 68 Parks, Environment and Water Bond Update
            - Proposition 68 was adopted by California voters in June 2018. It is a $4 billion bond to provide funding for water- and park-related projects and programs, administered through various agencies such as DWR and the SWRCB. Details as to what specific programs will be funded by Proposition 68 are not yet available; however, it is highly likely that Proposition 68 will provide grant funding for projects within the MIRWMP.

- **Low-interest Loan Programs.** Several funding agencies provide low-interest loans for implementation of water resources projects, saving implementing agencies significant amounts of money compared to traditional bonds. These include:
    - SWRCB Clean Water State Revolving Fund (SRF) Program: Historically, the Clean Water SRF program has had approximately $200 to $300 million available in loans each year to help cities, towns, districts, Native American tribal governments, and any designated and approved management agency under Section 208 of the Clean Water Act to construct publicly-owned facilities including wastewater treatment, local sewers, water reclamation facilities, nonpoint source projects, and development and implementation of estuary comprehensive conservation and management plans. The interest rate is half of the most recent General Obligation Bond Rate at the time of the funding commitment. Over the last five years, the Clean Water SRF loan interest rate has ranged from 1.5% to 2.1%, and loans are paid back over 30 years. Available loan funding is dependent upon federal appropriations.
    - SWRCB Drinking Water SRF Program: The DWSRF program provides financial assistance to public water systems to finance a wide variety of drinking water planning and infrastructure construction projects needed to achieve or maintain compliance with Safe Drinking Water Act. There is no application deadline and financing is limited only by the water system's ability to borrow. The interest rate is 50 percent of California's average general obligation bond rate obtained by the State Treasurer for the previous calendar year, 1.8% for 2018. Repayment term is up to 30 years and begins within one year after project completion.

- California Infrastructure and Economic Development Bank (I-Bank) Infrastructure SRF Program: The I-Bank ISRF Program provides financing to public agencies and nonprofit corporations sponsored by public agencies for a wide variety of infrastructure and economic development projects. Funding is available in amounts ranging from $50,000 to $25 million, with repayment terms ranging from the useful life of the project up to a 30-year maximum.
- DWR CalConserve Water Use Efficiency Revolving Fund: totals approximately $6 million, $1.75 million loaned for water use efficiency and approximately $5 million for fixing customer leaks. The two types of eligible projects are: pilot projects for local agencies to provide water use efficiency upgrades to customers at no upfront costs, and for local agencies to provide low-interest loans to customers to finance the installation of onsite improvements to repair or replace water pipes to conserve water. $3 million is available for individual projects, with a minimum of 50% local funding match, and projects may be financed up to 20 years or the useful life of the project, whichever comes first.

10.2 Operation and Maintenance Funding for Implemented Projects

Ongoing support and funding for operation and maintenance costs of projects included in the MIRWMP are expected to be derived from many of the same sources that were identified to fund project implementation, including local sources such as user rates, user fees and special assessments. Generally, operation and maintenance costs for projects are borne by the local project sponsors. Since regional projects and programs often involve multiple partner agencies, the range of local sources available is broadened. The details of funding and financing 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, and operation and maintenance of facilities is typically developed as part of a project financing package.

Operation and maintenance costs of proposed implementation projects must be evaluated as the overall viability of a project is determined. Prior to advancing a project forward to implementation, an analysis must be completed to establish the ability to operate and maintain the project and project benefits following completion. The annual fiscal impact on user rates and the willingness of ratepayers to accept a potential increased cost of service must be included in this analysis.

To improve the Region’s ability to provide ongoing support to priority projects, agencies and stakeholders in the Region should work together to minimize associated operation and maintenance costs and gain savings from economies of scale.

Merced Integrated Regional Water Management Plan

Chapter 11 Technical Analysis

This chapter addresses the IRWM Technical Analysis Plan Standard which requires IRWM Plans to:

✓ Document the data and technical analyses that were used in the development of the IRWM Plan

The MIRWMP was developed using sound technical information, analyses, and methods. The objectives, RMS, and implementation projects contained in the MIRWMP are based on water management needs forecasted for a minimum of a 20-year horizon. Information and documents were collected from various sources including MIRWMA member agencies (MID, Merced County, City of Merced, City of Livingston, and City of Atwater), DWR, USGS, USBR, USEPA, and other relevant agencies.

Multiple local planning documents were reviewed and used to prepare the MIRWMP. These include UWMPs, Water Management Plans, the Merced Groundwater Basin Groundwater Management Plan Update, Municipal Service Reviews, documents associated with the Merced County General Plan Update and project feasibility studies and assessments. While some of these are project-specific documents, others address water management issues on a local or regional basis. This allows for an understanding of regional issues shared by multiple entities in the Merced Subbasin as well as more specific, localized issues.

Table 11-1 summarizes some of the key planning reports used in the MIRWMP planning process. Additionally, the documents cited in the references section (Chapter 17 of this Plan) were reviewed and used in development of the MIRWMP.

Table 11-1: Foundational Documents Used to Create the MIRWMP

Document Title/Description	Publication Date	Source	Relation to MIRWMP
Unemployment Rate for Cities and Census Designated Places by Individual County (2016 and 2018)	September 2018	California Employment Development Department (CA EDD)	Information related to unemployment rates for cities and places within Merced County
Draft Report, City of Livingston Municipal Service Review	February 2018	Economic & Planning Systems, Inc	Information related to City of Livingston's sewer and waste services and capital improvement projects
East Stanislaus Integrated Regional Water Management Plan Update	February 2018	Woodard & Curran	Information related to the comprehensive understanding of regional water management in overlapping areas of the regions
California Indian Trust Land	January 2018	Bureau of Indian Affairs (BIA)	Information related to Indian land currently held in Trust by the U.S. Government used to identify existence of any tribal communities within the Region
California Water Plan Update 2013	2018	DWR	Information related to California's updated strategic plan for sustainably managing and developing water resources including RMS to be employed by the Region

Document Title/Description	Publication Date	Source	Relation to MIRWMP
Climate Change Sea Level Rise	2018	California Coastal Commission (CCC)	Information related to climate change and potential sea rise impacts
Clean Zero-Emission Hydroelectric Energy	2018	MID	Information related to the Merced River's two Hydroelectric Powerhouses
Information on Merced Groundwater Subbasin Groundwater Sustainability Plan (Homepage)	2018	Merced SGMA	Information related to the Merced Subbasin GSP and its current events and workshops
2017 Population Estimates	2018	U.S. Census Bureau	Information related to regional population estimates
Atmospheric River Storms	2018	U.S. Geological Survey (USGS)	Information related to weather patterns and rain currents
City of Merced 2015 Urban Water Management Plan	November 2017	Carollo	Information related to City of Merced's water system, urban water needs, management and planning objectives
Merced River Watershed: Climate Change Impact Report	October 2017	Dewberry	Information related to potential climate change projections and impact to the Region's water supply
Frequently Asked Questions about Hexavalent Chromium in Public Water Systems	September 2017	SWRCB	Information related to hexavalent chromium concentrations, potential impacts, and the creations of an MCL
California American Water Acquires Meadowbrook Water Company	April 2017	Business Wire	Information related to water companies within the Merced Region
Chowchilla Water District Water Management Plan, 2014 Criteria	April 2017	CWD	Information related to City of Chowchilla's water system, urban water needs, management and planning objectives
2016 Report on Agriculture	2017	Merced County	Information related to acreage, production, and gross value of Merced County's agricultural commodities
City of Livingston 2015 Urban Water Management Plan	October 2016	City of Livingston	Information related to City of Livingston's water system, urban water needs, management and planning objectives
2016 Integrated Regional Water Management Grant Program Guidelines	July 2016	DWR	Guidance on preparation of the IRWMP including information to include to address Plan Standards, websites and documents to reference,

Document Title/Description	Publication Date	Source	Relation to MIRWMP
			and methods for data gather, stakeholder involvement, etc.
Water Quality Control Plan for the Sacramento and San Joaquin River Basins	July 2016	CVRWQCB	Information related to navigable waters within the region including beneficial uses and TMDLs
Merced County General Plan Update, Land Use Element	July 2016	Merced County	Information related to current and projected land use and buildout
Merced Irrigation District Agricultural Water Management Plan	July 2016	MID	Information related to establishing Efficient Water Management Practices which include conservation measures such as water metering, volumetric pricing, and conjunctive use
Agricultural Water Management Plan	June 2016	Lone Tree Mutual Water Company (LTMWC)	Information related to establishing Efficient Water Management Practices which include conservation measures such as water metering, volumetric pricing, and conjunctive use
City of Atwater General Plan, Housing Element	March 2016	EMC Planning Group, Inc	Information related to projected housing needs and buildout for the City of Atwater
Disadvantaged Communities Mapping Tool	2016	DWR	MHI and DAC data for census tracts, block groups, and places in California used to identify the locations of DACs in the Region
Information on Sierra Nevada Adaptive Management Plan (Homepage)	2016	UC Science Team	Information related to Sierra Nevada forest management
2012-2016 American Community Survey 5-Year Estimates	2016	U.S. Census Bureau	Information related to city and community service district population estimates
Merced County Poverty Status in the Past 12 Months	2016	U.S. Census Bureau	Information related to poverty rates within the Merced County
What Climate Change Means for California	2016	U.S. Environmental Protection Agency (USEPA)	Information related to projected climate change impacts throughout California
Chowchilla Water District SBx7-7 Supplement Report, 2015 Update	December 2015	CWD	Additional documentation to accompany CWD's Water Management Plan

Document Title/Description	Publication Date	Source	Relation to MIRWMP
2015 Agricultural Water Management Plan	November 2015	Turlock Irrigation District (TID)	Efficient Water Management Practices, which include conservation measures such as water metering, volumetric pricing, and conjunctive use
Creating an Opportunity: Groundwater Recharge through Winter Flooding of Agricultural Land in the San Joaquin Valley	October 2015	RMC Water and Environment	Information related to creating additional groundwater recharge sources
Merced Stormwater Program: Program Effectiveness Assessment and Improvement Plan for City of Merced, City of Atwater, and Merced County	June 2015	WGR Southwest, Inc. – Environmental, Health & Safety Consultants (Lorraine M. Carrasquillo)	Information related to evaluation of the Merced SWMP and its implementation
Planada Community Services District Municipal Services Review	2015	Economic and Planning Systems, Inc	Information related to Planada CSD's sewer and waste services and CIPs
2012-2015 Drought Impacts to the Lyell and Maclure Glaciers	2015	Stock, Greg, et al	Information related to glacial retreat and volume change
Merced Integrated Regional Water Management Merced Region Drought Grant Proposal	July 2014	RMC Water and Environment	Information regarding Merced regional projects funded through the IRWM Grant Program
Order R5-2014-0096, NPDES NO. CA0079219, Waste Discharge Requirements for the City of Merced, Merced Wastewater Treatment Facility	2014	CVRWQCB	Information related to waste discharge requirements
San Luis v. Jewell, Summary	2014	U.S. Count of Appeals for the Ninth Court	Information related to CVP and SWP operations and impacts on the Delta Smelt
Merced Integrated Regional Water Management Plan: Salt and Nutrient Study	August 2013	RMC Water and Environment	Information related to current salt and nutrient concentrations within the Merced Region
Merced Integrated Regional Water Management Plan: Climate Change Study	August 2013	RMC Water and Environment	Information related to projected climate change impacts within the Merced Region

Document Title/Description	Publication Date	Source	Relation to MIRWMP
Merced Integrated Regional Water Management Implementation Grant Proposal	March 2013	RMC Water and Environment	Information regarding Merced regional projects funded through the IRWM Grant Program
Merced Integrated Regional Water Management Plan: Groundwater Recharge Feasibility Study	February 2013	RMC Water and Environment	Information related to groundwater recharge within the Merced Region
Census of Agriculture, County Profile – Merced County	2012	U.S. Census Bureau	Information related to number of farms, size, and agricultural items produced within Merced County
Quantifying 20th Century Glacier Change in the Sierra Nevada, California	August 2011	Fountain, Andrew G. and Hassan J. Basagic	Information related to climate change impacts on glacial water supply and recharge
Basin Report: Sacramento and San Joaquin Rivers	2011	U.S. Bureau of Reclamation (USBR)	Information related to current and future water supplies and demands in the Sacramento and San Joaquin Rivers
Merced River Alliance Project, Final Report, Volume I, Outreach and Education	September 2008	Stillwater Sciences	Information related to existing watershed studies and planning along the Merced River
Merced Groundwater Basin Groundwater Management Plan Update	July 2008	AMEC Geomatrix, Inc.	Information related to groundwater conditions and management
Program Report: Dewvaporation Desalination 5,000-Gallon-Per-Day Pilot Plant	June 2008	L'Eau LLC (James R. Beckman)	Information related to design, build, and operation of a treatment plant and associated costs and capabilities
Uncertainty in hydrologic impacts of climate change in the Sierra Nevada, California under two emissions scenarios	June 2007	Maurer, Edwin P.	Information related to projected hydrologic changes based on modeled climate change impacts
Merced Storm Water Group Storm Water Management Program	April 2007	Stantec	Information related to the existing stormwater conveyance system
Climate Change 2007: Synthesis Report	2007	IPCC	Information related to observed changes and projected impacts from climate change
Water Recycling 2030: Recommendations of California's Recycled Water Task Force	June 2003	DWR	Information related to California's current recycled water framework and regulations and identified opportunities for increasing its use

Document Title/Description	Publication Date	Source	Relation to MIRWMP
Order No. 89-171, Waste Discharge Requirements for Franklin County Water District Wastewater Treatment Facility, Merced, Merced County	1989	CVRWQCB	Information related to waste discharge requirements

The MIRWMP includes a list[2] of projects, programs, studies, and planning activities that local and regional planners have found to be technically feasible based on similar projects, pilot studies, technical analyses, benefit analyses, cost estimating, modeling and simulation efforts, and data assessments. As each project moves closer to design and implementation, technical and economic analyses will be conducted to confirm project feasibility and provide any necessary feedback to modify the project's plan to improve its likelihood of success. The online project database contains project-specific documentation that supports the technical feasibility of MIRWMP project and plan implementation.

In development of the MIRWMP, the following data gaps were identified:

- Up-to-date, spatially-referenced land use data that includes recent agriculture-to-agriculture conversions that impact water demands in the Region.
- Groundwater data to assess current groundwater conditions and to determine necessary management activities.
- Local groundwater water quality data to determine the suitability of recharge areas.

Data gaps will be addressed through implementation of projects specifically designed to collect needed data or indirectly through data reported in project performance monitoring plans (Section 8.2). Data gaps may also be filled through the Merced SGMA process and Merced SWRP and GSP implementation. Land use and water demand information should be developed at the local level, which is beyond the scope of the MIRWMP as an umbrella document. However, implementation of the MIRWMP can assist with the collection of groundwater data, which can be readily collected through project-specific monitoring plans.

2 For a current list of the MIRWMP projects, programs, studies and planning activities, visit http://mercedirwmp.org/projects.html

Merced Integrated Regional Water Management Plan

Chapter 12 Relation to Local Water Planning

This chapter addresses the IRWM Relation to Local Water Planning Standard which requires IRWM Plans to:

- ✓ List local water plans used in the IRWM Plan
- ✓ Discuss how the IRWM Plan relates to planning documents and programs established by local agencies
- ✓ Describe the dynamics between the IRWM Plan and local planning documents
- ✓ Consider and incorporate water management issues and climate change adaptation and mitigation strategies from local plans into the IRWM Plan

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The MIRWMP builds upon a wide variety of existing local water plans and studies, as well as ongoing studies which are under development. The MIRWMP uses these existing documents, plans and programs to establish a planning baseline for water resources management throughout the Region.

Local water planning documents set forth water resources management policies and projections at the local level. Through their role in determining land use and development types, patterns, and densities, these local plans dictate the location and extent of impervious surfaces, quantity and density of population, areas of open space, and other characteristics fundamental to water resources planning. As such, local plans ultimately serve as the basis for water resources management planning, and consequently for MIRWMP development as well. The relationship and linkages between these local planning documents and the MIRWMP are described in the following subsections.

A complete list of documents used to develop the MIRWMP, including local water plans, can be found in Chapter 11, Technical Analysis. Table 11-1 also summarizes the relation of each document to the MIRWMP.

12.1 Relationship between MIRWMP and Local Planning Documents and Programs

12.1.1 Water Supply and Water Quality Planning

Planning departments throughout the Region are continually developing documents that establish population projections and water use projections at the local level. These local planning efforts serve as the basis for development of UWMPs and AWMPs. These documents are developed and adopted by local water agencies and municipalities and are submitted to the State for acceptance. The information in these UWMPs and AWMPs is local to the preparing water agency or municipality, and builds upon the local planning information presented in local plans such as general plans and municipal service reviews (MSRs). Rather than superseding the local planning documents, the MIRWMP uses these documents as a basis for developing a wider, regional view of water supply, demand, and quality throughout the Region, including potential climate change adaptation and mitigation measures. The cities of Livingston and Merced both prepared 2015 UWMPs. AWMPs were prepared by CWD, LTMWC, and MID. Information and data from these plans was used in various chapters of the MIRWMP, including the Region Description, RMS, and Climate Change chapters. MIRWMA will also be coordinating, as needed, relative to SGMA and its applications to other water management disciplines.

In addition to building on these local agency plans, the MIRWMP compiles information from water resources management plans developed by local agencies where local planning entities have identified preferred projects for implementation at the local level. As water supply agencies within the Region engage in planning efforts, they may coordinate with each other, state and federal agencies, and other local planning entities, as necessary.

12.1.2 Wastewater and Recycled Water Planning

Local wastewater and recycled water agencies and municipalities create various plans and documents which are used to develop projects for future implementation. These plans and documents include wastewater and recycled water master plans, facilities plans, and feasibility studies. These master plans, facilities plans and feasibility studies build upon the water supply and demand information developed in UWMPs and based on local planning documents such as General Plans to project future wastewater flow quantity and quality. Based on these projections, local wastewater and recycled water agencies and municipalities develop plans to manage these flows. Further, based on the land use types outlined through the general planning process, these agencies are able to evaluate potential markets for recycled water use at the local level. The MIRWMP compiles and builds upon these local documents to develop a regional picture of wastewater and recycled water planning. Project proponents also use these local planning documents to identify projects for inclusion in the MIRWMP and justify technical feasibility. Wastewater and recycled water planning are also discussed in UWMPs; key information on these topics is included in the Region Description chapter. As discussed in this plan, entities with recycled water suitable for agricultural use are seeking a water exchange with MID for surface water to be applied over urban communities' landscape areas. The intent is to reduce the carbon footprint and pumping cost as the water is returned upgradient to the urban community. Another main goal for such exchange is to prevent the introduction of certain constituents inherent to recycled water, such as pathogens, into the drinking water system through deep percolation of landscape irrigation. These projects have also been captured in local planning documents such as UWMPs.

12.1.3 Groundwater Management Planning

Existing groundwater management documents in the Region include the 2008 *Groundwater Management Plan Update*, adopted by MAGPI (whose Board of Directors includes many water suppliers within the Region listed in Section 2.6.1). This document informed the MIRWMP's discussion of groundwater in Chapter 2, Region Description.

As discussed in Chapter 2, MIRWMA member agencies are coordinating with a variety of regional agencies and the State on SGMA compliance. Seven GSAs have been established in the Region (Merced Irrigation-Urban GSA, Merced Subbasin GSA, Turner Island Water District, Chowchilla Water District, County of Merced Chowchilla GSA, East Turlock Subbasin GSA and West Turlock Subbasin GSA); these GSAs are working together to complete GSPs in order to comply with SGMA. The majority of the Merced Region will be covered by a single GSP to be prepared by Merced Irrigation-Urban GSA, Merced Subbasin GSA, and Turner Island Water District #1, while the Chowchilla Subbasin will be covered by a single GSP prepared by the Chowchilla Water District GSA, County of Merced Chowchilla Subbasin GSA, Madera County GSA, and Triangle T Water District GSA. The Turlock Subbasin will be covered by a single GSP prepared by the East Turlock Subbasin GSA and the West Turlock Subbasin GSA. Information from the GSPs will be incorporated into future MIRWMP updates. MIRWMA will continue working alongside its member agencies and other regional stakeholders to identify management objectives, implement the GSPs, and actively monitor groundwater. Additionally, under SGMA, agencies will identify and execute management strategies to manage the basin in a sustainable manner. As SGMA evolves and GSPs are developed, further opportunities to coordinate groundwater management and IRWM planning will likely arise. Future updates to the MIRWMP will incorporate goals and findings of GSPs, including climate change adaptation and/or mitigation strategies. Projects identified as part of the IRWMP efforts may be included in GSPs as appropriate, and vice versa. With the Region's reliance on groundwater, coordination between the SGMA and IRWMP efforts will be valuable for implementing water management projects in the Region.

12.1.4 Flood Protection and Stormwater Management Planning

Flood protection and stormwater management intrinsically build upon local planning efforts, such as General Plans and Specific Plans. Dependent on the location and extent of impervious surfaces dictated through the local planning process, flooding issues can be either managed or exacerbated. In addition, stormwater runoff quality and quantity are directly influenced by the type, location, and density of adjacent development. Further, municipalities are increasingly tasked with development and implementation of stormwater management BMPs at the local level. As municipalities begin to address climate change adaptation and/or mitigation measures in their flood and stormwater planning, these measures will be incorporated into the MIRWMP. Such projects identified by cities and the County can also be added to the MIRWMP at any time.

The MIRWMP assembles local and regional information to establish a baseline understanding of flood and stormwater conditions across the Merced Region, as described further in Chapter 2, Region Description. Flood and stormwater management in the Region are also closely tied to climate change impacts, which are discussed in Chapter 16, Climate Change. Further, the MIRWMP builds upon work being conducted at the local level to enhance flood protection and stormwater management by considering the proposed local projects in the context of the greater regional challenges, goals and objectives.

In parallel with the 2018 MIRWMP Update, MIRWMA is preparing a SWRP, which provides an overview of stormwater conditions and issues within the Region. All of the stormwater or dry weather runoff projects included in the SWRP have also been included in the MIRWMP. As MIRWMA is leading both the MIRWMP and SWRP efforts and as both programs utilize the same online project database, extensive coordination has occurred between both programs. For example, project solicitation for the two plans occurred simultaneously using the same online project database. Project proponents had the opportunity to submit their projects to the IRWMP, SWRP, or both, using the same portal. This provided efficiency for project proponents and provides a strong link between the IRWMP and SWRP programs in the Region.

The Merced SWRP is considered to be incorporated into this IRWMP by reference. As the SWRP continues to evolve, updated SWRP information will be included in the IRWMP as appropriate.

12.1.5 Natural Resources Planning

Ecosystem protection and restoration projects are often closely tied to local land use planning efforts. Restoration of riparian and wetland habitats frequently occurs within urbanized areas or areas experiencing development pressure. As a result, local municipal approvals are required for implementation and maintenance to be effective. Local planning documents used in preparation of project design, construction, and environmental documents include general plans, specific plans, watershed management plans, habitat conservation plans, and stewardship plans. Specific documents used includes the *Merced County General Plan* and *2016 Report on Agriculture* (Merced County, 2013; Merced County, 2017), which relate to the overall description of the Merced Region and the planning of projects in relation to land use and natural resources.

In addition to local municipalities, water and flood control districts, resource and regulatory agencies, and non-governmental organizations (NGOs) all play key roles in development of local planning documents.

These agencies and organizations establish watershed and habitat management policies, programs, and projects which delineate ecosystem restoration activities throughout the Merced Region. Ecosystem restoration and habitat protection are particularly valuable in light of climate change, as natural resource managers throughout the Region will need to consider strategies for mitigating climate change and adapting to its impacts. For example, EMRCD is an active participant on the RAC and has proposed and received funding under the program to meet a variety of natural resources needs within the Region. The MIRWMP will incorporate strategies identified during natural resource planning efforts as they pertain to water management. Natural resource projects may also be eligible for inclusion in the MIRWMP (e.g., watershed restoration projects), providing another platform for additional coordination.

12.2 Dynamics Between MIRWMP and Local Planning Documents and Programs

As described above, the MIRWMP serves as an umbrella document, building upon the work developed at the local level to create a comprehensive planning document that encompasses all areas of water management. Water management conditions throughout the Region are not static; conditions are continually changing, and local planning documents are revised and updated periodically to reflect these changing conditions. The MIRWMP must, similarly, respond to changing conditions, particularly in light of climate change impacts. As described in Chapter 3, Governance, the MIRWMA will continue to review and update this Plan periodically. During the revision process, changes in local planning documents and completion of new local planning documents will be incorporated into the MIRWMP. In this way, the MIRWMP will respond to changing local water management conditions, and will continue to reflect the planning completed at the local level.

Merced Integrated Regional Water Management Plan

Chapter 13 Relation to Local Land Use Planning

This chapter addresses the IRWM Relation to Local Land Use Planning Standard which requires IRWM Plans to:

- ✓ Contain processes that foster communication between land use managers and RWMGs with the intent of effectively integrating water management and land use planning
- ✓ Document the current relationship between local land use planning, regional water issues, and water management objectives
- ✓ Identify future plans to further a collaborative, proactive relationship between land use planners and water managers
- ✓ Demonstrate information sharing and collaboration with regional land use planning in order to manage multiple water demands throughout the state, adapt water management systems to climate change, and potentially offset climate change impacts to water supply in California

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The Merced Region appreciates the importance of fostering communication between land use managers and water resource managers to effectively integrate water management and land use planning. This section documents the current relationship between local land use planning, regional water issues, and water management objectives in the Merced Region. Additionally, future plans to foster a collaborative, proactive relationship between land use planners and water managers are identified.

California State Law requires every city and county in the state to prepare and maintain a General Plan. General Plans provide a blueprint for future decisions regarding land use and resource conservation. Land use agencies that prepare these plans are responsible for managing growth and development while ensuring a healthy and sustainable economy. In the Merced Region, entities with land use authority include:

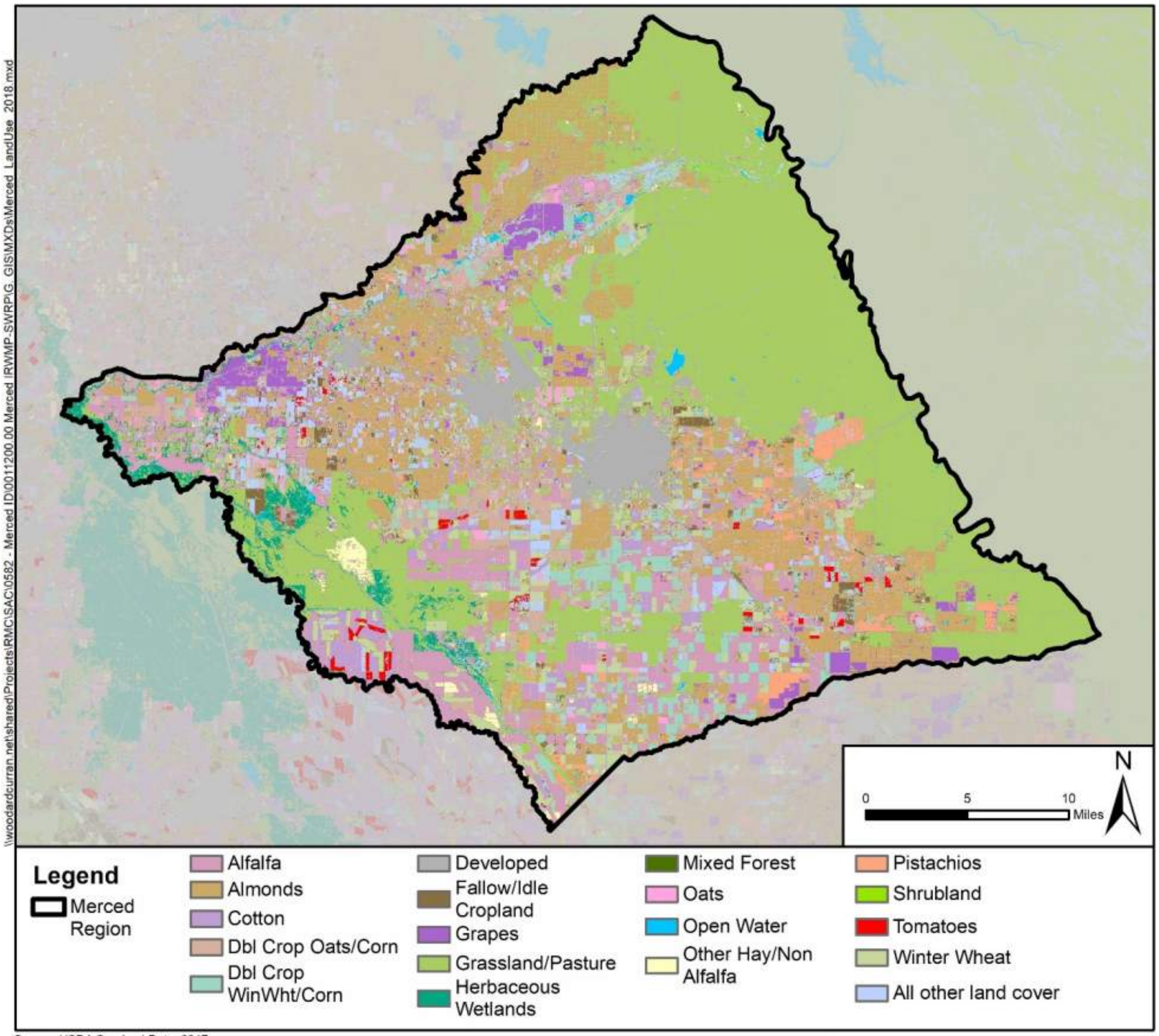
- County of Merced
- City of Merced
- City of Livingston
- City of Atwater
- UC Merced

Figure 2-10 includes the boundaries of these local land use agencies. These agencies implement public outreach efforts to help define the local community's vision for future growth and development. Stakeholders within the Merced Region are enthusiastic about the IRWM planning effort and the opportunity for more comprehensive land use considerations in developing future conceptual models for water management issues.

13.1 Coordination Between Water Management and Land Use Planning

Land use patterns in the Merced Region are dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crop, and nut and fruit trees, all of which rely heavily on water purveyors/districts, private groundwater wells, and surface water supply sources. Figure 13-1 shows the current land uses within the Region; the most common crop types/land cover types in Merced County as of 2017 is grassland/pasture (USDA, 2017). Other predominant crops include almonds, alfalfa, winter wheat, and cotton (USDA, 2017).

Figure 13-1: Current Land Uses in the Merced Region (2017)



Source: USDA Cropland Data, 2017

The interconnected surface water and groundwater system in the Merced Region is complex, and water quality is both directly and indirectly affected by land use practices throughout the Region. Stormwater drainage, precipitation-based sheet flow, agricultural drainage, wastewater effluent, and other contributing sources can dramatically affect surface water quality and quantity. Precipitation, irrigation, and recharge-based infiltration through variable surfaces and soil types in different land use settings also affect groundwater quality and quantity. In addition, groundwater additions to surface waters have interrelated impacts to both surface and groundwater resources. Manmade and natural conveyances, including irrigation and flood management projects, have the potential to transfer water sources with significantly different characteristics throughout the Merced Region. Public, domestic, irrigation and industrial production wells can create highly variable groundwater flow patterns and cones of depression affecting groundwater elevations and regional flow directions temporally and spatially, ultimately affecting the quality and quantity of groundwater in the Subbasin. The Merced IRWM program presents a structured opportunity to integrate water management activities related to natural and manmade water systems, including water supply reliability, water quality, environmental stewardship, recreation, and flood management in the Merced Region.

13.2 Current Relationships Between Water Managers and Land Use Planners

The Merced Region encompasses a variety of agencies with water management responsibilities. Four of these water management agencies also have local land use jurisdiction: the City of Atwater, City of Livingston, City of Merced, and Merced County. Participation by these agencies in this IRWM planning process allows for water planning activities to be an integral part of land use planning processes within these agencies' jurisdictions. As these agencies engage in both land use and water planning, information can be easily shared internally. Additionally, planning efforts or projects may include public engagement processes or inter-agency collaboration; this provides another venue for outside land use or water management agencies to participate in efforts throughout the Region. Local agencies have also been coordinating as they work to prepare GSPs to comply with SGMA. Land use and water planning are also closely linked with climate change planning. As agencies throughout the state work to provide a reliable water supply in the face of climate change impacts, further coordination to provide innovative regional and local solutions will be crucial. Efforts such as the MIRWM program provide a valuable basis for this type of coordination in the future. For example, this MIRWMP includes multiple water use efficiency projects, which will help the Region adapt to potential future reductions in water supply due to climate change impacts.

Although water infrastructure within Merced County is highly decentralized (with over 25 irrigation and local special districts, as well as private companies serving relatively small areas), the Region has a history of strong participation in the IRWM planning process, as evidenced by the formation of the MIRWMA JPA and RAC. SGMA and the Merced SWRP provide additional frameworks for coordination and collaboration. Although most irrigation districts are independent entities created under California law, each governed by separate elected boards and managed by individual staff, they may decide to increase their level of participation in the MIRWMP or other region-wide efforts. Land use planning is addressed for each of the water and sanitary districts within the Merced County General Plan, and a Municipal Service Review (MSR) was also prepared by the County to assess the services provided. MSRs aid in land use planning by evaluating factors such as growth projections, facility capacities, and opportunities for shared facilities. Through mechanisms such as General Plans and MSRs, land use planners consider water management and work to set appropriate standards for future land use.

13.3 Future Coordination Opportunities

The IRWM program presents a unique opportunity to help water planners, land use planners, and the public work together, identify efficiencies, foster communication, and integrate water management and land use planning. Four of the five agencies represented by MIRWMA – Merced County, the City of Merced, the City of Atwater and the City of Livingston – have local land use planning authority in the Region. UC

Merced, which has considerable land use influence, has been represented on the RAC and on the stakeholder contact list.

As IRWM planning continues in the Region, the following actions may be taken to enhance coordination and communication between water resources managers and land use planners.

- Targeted forums for land use planners and water resource managers may be held to improve understanding of the nexus between land use planning and water management. For example, meetings between water managers and land use planners may be arranged to discuss regional water issues and concerns and identify areas for enhanced collaboration. Ultimately, these discussions are expected to generate multi-benefit IRWM projects that will assist the Region in meeting its objectives while maintaining consistency with local land use designations.
- Early consultation regarding land use decisions as suggested by the Ahwahnee Water Principles for Resource-Efficient Land Use will be encouraged (Local Government Commission 1991). The Ahwahnee Water Principles consist of nine community principles and five implementation measures developed by leading water experts from the national, state, and local levels. These principles and measures address concerns about stormwater runoff, flood damage, and local water supply reliability for current residents and new development by identifying cost-saving stewardship actions that cities and counties can implement. The Merced Region believes that all five Ahwahnee Implementation Principles for Resource-Efficient Land Use should be applied, as appropriate. These five principles are:
    1. Water supply agencies should be consulted early in the land use decision-making process regarding technology, demographics and growth projections.
    2. City and county officials, the watershed council, Local Agency Formation Commission, special districts, NGOs, and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a watershed level.
    3. The best, multi-benefit and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.
    4. From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information.
    5. Plans, programs, projects and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices (Local Government Commission, 2012).

Implementing these actions will ultimately benefit the Region by:

- Fostering enhanced understanding of water supply and water quality impacts associated with land use planning decisions;
- Improving representation of water-related needs and regional objectives related to land use planning; and
- Identifying IRWM projects and programs that address regional objectives as well as local land use planning goals.

As previously described, the IRWM planning process will provide the Region's water managers and land use planners with an established forum to engage in discussion regarding water management issues and land use plans. RAC meetings will continue to provide an interface for the water and land use managers to express concerns and propose solutions. In the future, should a more robust and detailed approach be needed to further establish relationships between land use and water planners, some or all of the options previously described may be implemented.

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Merced Integrated Regional Water Management Plan

Chapter 14 Stakeholder Involvement

This chapter addresses the Integrated Regional Water Management (IRWM) Stakeholder Involvement Plan Standard which requires IRWM Plans to:

- ✓ Contain a public process that provides outreach and an opportunity to participate in IRWM Plan development and implementation to the appropriate local agencies and stakeholders, as applicable to the region, including wholesale and retail water purveyors, wastewater agencies, flood control agencies, municipal and county governments and special districts, electrical corporations, Native American tribes, self-supplied water users, environmental stewardship organization, community organizations, industry organizations, State, federal and regional agencies or universities and DAC members
- ✓ The process used to identify, inform, invite and involve stakeholder groups in the IRWM process including mechanisms and processes that have been or will be used to facilitate stakeholder involvement and communication during development and implementation of the IRWM Plan
- ✓ Discuss how the RWMG will endeavor to involve DACs and Native American tribal communities in the IRWM planning effort
- ✓ Describe the decision-making process including IRWM committees, roles or positions that stakeholders can occupy and how a stakeholder goes about participating in those committees, roles or positions regardless of their ability to contribute to the Plan financially
- ✓ Discuss how stakeholders are necessary to address objectives and resource management strategies of the IRWM Plan and are involved or are being invited to be involved in Plan activities
- ✓ Discuss how collaborative processes will engage a balance of interest groups listed above in the IRWM process regardless of their ability to contribute financially to the IRWM Plan’s development or implementation

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The Merced IRWM process is a strongly stakeholder-driven process. While the RWMG, MIRWMA, retains overall responsibility for ongoing IRWM planning and implementation of the MIRWMP, the planning and implementation work is primarily generated by the RAC, a multi-disciplinary stakeholder group designed to represent the broad interests of the Region. Opportunities also exist for individuals not participating on the RAC to participate in the IRWM program as discussed in this chapter.

14.1 Opportunities for Stakeholder Participation

14.1.1 Regional Advisory Committee

Chapter 3, Governance, describes the roles and responsibilities of RAC in detail. This section discusses the public process used to form the RAC that advised the RWMG through development of the 2013 MIRWMP, as well as the 2018 MIRWMP update, and the process that has been, and will continue to be, used to continue stakeholder involvement throughout MIRWMP implementation.

In January 2018, MIRWMA invited applications for community and business representatives to serve on a Regional Advisory Committee for the 2018 MIRWMP Update. This process was advertised by MID, Merced County and the City of Merced via email, announcements in other water-related meetings (e.g., GSA coordination meetings), and personal outreach. Individuals with a demonstrated commitment to community service and civic leadership, prior experience participating on similar task forces and advisory committees, and an understanding of water issues, or who represent the diversity of the region, including community, business, agriculture, environmental, and recreational perspectives on water, wastewater, groundwater, flood management, and water quality were encouraged to apply to serve on the RAC.

The RAC includes members representing the following interests:

- Water Supply Interests
- Wastewater Interests
- Flood Control Interests
- Local Government
- Agricultural Interests
- Other Non-Agricultural Business Interests
- Environmental Interests
- Educational Interests
- Disadvantaged Community and Environmental Justice Interests
- Recreational Interests
- Community / Neighborhood Interests

The RAC that advised MIRWMA through development of the 2018 MIRWMP Update included 16 members. The RAC allows for stakeholder participation regardless of ability to contribute financially to the MIRWMP.

14.1.2 Public Participation

The composition of the RAC is intended to ensure that the varied interests and perspectives of the Region are represented; however, individuals who are not members of the RAC but are interested in maintaining active involvement in the IRWM program are encouraged to do so. All meetings of the RAC are open to the public to allow any interested parties to participate in the IRWM program, and MIRWMA and the RAC have and will continue to host public workshops at critical junctures in the IRWM planning process (e.g. plan updates, calls for projects, etc.).

The RWMG (now MIRWMA) and RAC have coordinated with different agencies throughout the Merced Region to host public workshops. The workshops shown here were held in Merced and Livingston.

Stakeholder outreach began early in the development of the 2013 MIRWMP. Because the MIRWMP was initially spearheaded by a subcommittee of MAGPI, the IRWM program has benefitted from the legacy of MAGPI's established stakeholder relationships. The MAGPI stakeholder list was used as a starting point for MIRWMP public outreach, and the list was expanded during the Merced IRWM RAP by circulating an invitation letter to organizations throughout the Region. During development of the MIRWMP, the RWMG and RAC continued to reach out to interested parties by personally contacting potentially-interested individuals and hosting public workshops. The workshops were advertised through multiple outlets including public service announcements, newspaper advertisements, web postings and e-mail distribution lists. The IRWM stakeholder list was updated with contact information provided by individuals attending the public workshops. During the 2018 MIRWMP Update, the stakeholder list was updated with interested parties identified to date as part of the Merced GSP. Also in 2018, two public workshops were held in order to foster coordination with the public and seek input in the process. The stakeholder contact list included representatives from a wide variety of interests, including:

- Water Supply Interests (including water purveyors and self-supplied water users, as described in Plan Standards)
- Wastewater Interests (including wastewater agencies, as described in Plan Standards)
- Stormwater Interests
- Flood Control Interests (including flood control agencies, as described in Plan Standards)
- Local Government (municipal and county governments and special districts, as described in Plan Standards)
- Agricultural Interests
- Other Non-Agricultural Business Interests (including industry organizations and electrical corporations, as described in Plan Standards)
- Environmental Interests (including environmental stewardship organizations, as described in Plan Standards)
- Other Institutional Interests (e.g. UC Merced)
- Disadvantaged Community and Environmental Justice Interests
- Recreational Interests
- Community / Neighborhood Interests

In addition to the public workshops, the public was able to participate in the 2018 MIRWMP Update via submission of projects to the MIRWMP, submission of comments on the Public Draft MIRWMP, and participation in RAC meetings.

In order to disseminate information to a wide audience, the Merced Region created the Merced IRWMP website (www.mercedirwmp.org) which includes information about the IRWM program. The homepage features a News and Events section, which is intended to keep visitors informed of upcoming meetings. The website also contains a Documents section where public meeting agendas and notes, working documents, and final reports are posted.

News and events related to the IRWM program will also continue to be posted on the MIRWMA member agencies' websites.

14.1.3 Project Proponents

Project proponents are the stakeholders with primary responsibility for implementing projects listed in the MIRWMP. As with other stakeholders, project proponents are encouraged to maintain active involvement in the IRWM program. Project proponents can volunteer to serve on the RAC by following the application process outlined in Chapter 3, Governance, or they may participate as general public participants.

Since project proponents are the entities implementing IRWM projects, their involvement is necessary to address objectives and RMS of the MIRWMP.

14.1.4 DAC Representation

The majority of the Merced Region (88%) is currently considered a DAC. As discussed in Chapter 2, Region Description, the Region includes the incorporated cities of Atwater, Livingston, and Merced, and the unincorporated communities of Cressey, El Nido, Franklin/Beachwood, Le Grand, Planada, Snelling, Stevinson and Winton. All of these communities, with the exception of Cressey, have MHIs of less than 80% of the statewide MHI, thus meeting the State's definition of a DAC (based on data from 2010-2014 obtained from DWR's DAC Mapping Tool, https://gis.water.ca.gov/app/dacs/). Although Cressey is not recognized as a DAC by the State's definition, due to local knowledge of economic conditions, for the purposes of the MIRWMP it is considered to be a DAC.

From the beginning stages of MIRWMP development, the RWMG worked to include DAC representation in the planning process. DAC and EJ interests were identified as a specific interest group recruited for participation on the RAC. During preparation of the first MIRWMP in 2013, DAC interests were represented on the RAC by one member and one alternate. Throughout development of the 2018 MIRWMP Update, DAC interests were represented by two dedicated RAC members. Further, the Cities of Atwater, Livingston, and Merced are members of MIRWMA and are represented on the Management Committee; these cities all qualify as DACs. Merced County also helps to represent unincorporated DACs on the Management Committee. Additionally, staff from the Le Grand and Planada CSDs, both DACs, participate in the Management Committee. The RAC includes a diverse list of community members who represent interests such as farming, business, and education; the RAC contributes their local knowledge of DAC needs to the MIRWMP.

14.1.5 Outreach to Native Americans

As of January 2018, there were no federally- or State-recognized Native American Tribes in the Merced Region. This determination was made using maps published by the Bureau of Indian Affairs (BIA), Pacific Region (BIA, 2018). In the event that Native American tribes are recognized in the Region in the future, they would be invited to participate in the MIRWMP process. Participation could occur through the existing governance structure (e.g., participation on the RAC), or the governance structure could be revised in order to foster participation at a higher level of the governance structure (such as MIRWMA).

14.2 Decision Making Process

The RAC decision-making process is described in Chapter 3, Governance, and Section 3.6, Decision-Making Process.

14.3 Stakeholder Integration

The Merced Region's governance structure enables a diverse group of stakeholders to participate in all levels of the IRWM planning effort regardless of their ability to contribute financially to the MIRWMP as required by the California Water Code §10541(h)(2). The RAC, which is described in Chapter 3, Governance, is designed to encompass diverse interests and does not require financial contributions from its members. The RAC is also structured to enable participation at all levels of the IRWM program. The foundation of the IRWM program is the planning work that has been and will continue to be completed by the RAC and workgroups of the RAC. At the policy level, the RAC is able to provide direct input to MIRWMA through its liaison to the MIRWMA Board. Other interested parties are able to participate in all levels of the IRWM program as all meetings of the RAC, the MIRWMA Board and meetings of the MIRWMA are open to the public.

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Merced Integrated Regional Water Management Plan

Chapter 15 Coordination

This chapter addresses the IRWM Coordination Plan Standard which requires IRWM Plans to:

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

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The Region coordinates water management activities on multiple levels – within the region, with neighboring IRWM regions, and with other agencies.

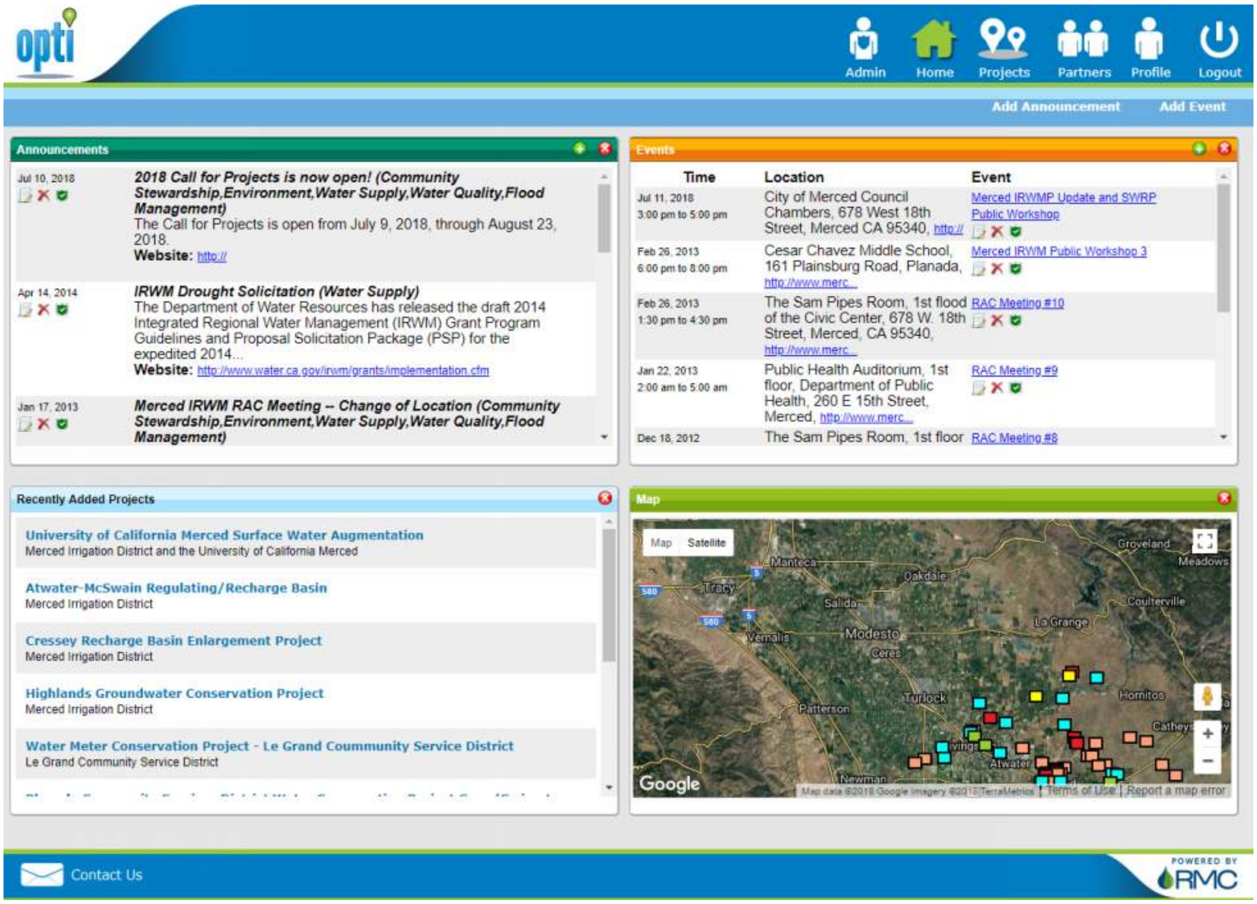
15.1 Coordination within the Merced Region

In addition to the regular coordination meetings of the RAC and MIRWMA Board (refer to Chapter 3, Governance), the IRWM program provides two web-based venues for local agencies and stakeholders to coordinate and identify opportunities for cooperative project: the Merced IRWMP website and Merced online project database.

The Merced IRWMP website, www.mercedirwmp.org, was developed early in the IRWM planning process to serve as a source of information for individuals interested in learning basic information about the IRWM program. During the development of the 2013 MIRWMP, the RWMG enhanced the website to include meeting notifications, meeting materials and documents developed through the IRWM planning process. During the 2018 IRWMP Update, materials were posted to the website including information about public meetings and the Call for Projects and RAC meeting materials. Program materials are posted to the website to keep stakeholders informed of activities being pursued at the regional level.

The Merced Region's online project database (http://irwm.rmcwater.com/merced/) was launched during the Region's first Call for Projects in 2012 and updated for the 2018 Call for Projects. Beyond serving the fundamental role of maintaining the Region's project list, the database provides a venue for increased collaboration between and among project proponents and related programs. The Merced Region's online project database allows any member of the public that registers for access to view and follow projects of interest. Users that register as community members also have the ability to enter new projects and share projects with other community members, enabling multiple entities to collaborate on a single project.

Figure 15-1: Merced Online Project Database



15.2 Coordination with Neighboring IRWM Regions

Through the RAP and DWR's acceptance of the Merced Region as an IRWM Region, the Region has clearly demonstrated how water management within its boundaries is distinctly different than its neighboring regions. The Region's boundaries are defined by the eastern boundary of the Merced Groundwater Subbasin to the east, the San Joaquin River to the west, the northern boundary of the Dry Creek watershed to the north, and the Chowchilla River to the south. The eastern and western boundaries of the Merced Region are critical hydrogeologic features that distinguish the Region from neighboring regions. The crystalline basement rock that defines the Region's eastern boundary divides the groundwater/alluvial basin of the Merced Region from the fluvial and fractured rock systems of the mountainous watersheds of Tuolumne, Mariposa and Madera Counties. On the west, the San Joaquin River marks the boundary between Merced Subbasin and the Delta-Mendota Subbasin and is also the dividing line between the Merced IRWM Region and Westside-San Joaquin IRWM Region.

Beyond having distinctly different groundwater basins, the Merced IRWM Region has different water management and land use patterns than the Westside-San Joaquin Region, including the Merced Region's lack of reliance on imported water supplies. Additionally, while areas both east and west of the San Joaquin River are dominated by the agricultural industry of the Central Valley, the agricultural economy of the

Merced Region is typified by small-scale multi-generational family farming operations, in contrast to the dominantly large-scale commercial agricultural operations common in areas west of the San Joaquin River.

Although the Merced Region functions independently of its neighboring IRWM regions, MIRWMA and the RAC appreciate the importance of coordinating with neighboring regions, particularly given their shared groundwater and surface water resources. Coordination with adjacent RWMGs can result in better utilization of these resources and avoid potential conflicts. The value placed upon coordination with neighboring regions is reflected in the Region's project review process, which awards additional points to projects that are supported by multiple local project sponsors, including contiguous IRWM regions (see Chapter 6, Project Review Process).

The following IRWM Regions are located adjacent to the Merced Region (Figure 1-1).

- Yosemite-Mariposa
- Madera
- Westside-San Joaquin
- East Stanislaus
- Tuolumne-Stanislaus

During the RAP process, the Merced Region, which was represented by MAGPI at the time, sent letters to neighboring RWMG representatives expressing the Merced Region's interest in entering into a Memorandum of Understanding or other letter agreement that outlines areas of cooperation with its neighboring regions.

Of the neighboring regions, MIRWMA and RAC are most interested in the Yosemite-Mariposa and Madera IRWM Regions as activities that occur within these watersheds have the greatest potential to affect the Merced Region. MID participates on the Regional Water Advisory Council of the Yosemite-Mariposa IRWM; MID's involvement in both the Yosemite-Mariposa and Merced Regions provides for regular communication between the two regions and allows for improved coordination between the regions. MID has also participated in the Madera IRWM planning processes and may support common projects in the future. Similarly, representatives from the Yosemite-Mariposa and Madera Regions have indicated an interest in Merced IRWM planning efforts and have participated in Merced RAC meetings during preparation of the 2013 MIRWMP. Staff members from Merced County and MID, both of which are members of MIRWMA, routinely meet with members of the East and West Turlock Subbasin GSAs, and several East and West Turlock Subbasin GSA members (Cities of Modesto, Ceres, Turlock, Hughson, Waterford, and Stanislaus County) are members of the East Stanislaus Region. Finally, staff members of Merced County also participate in the Delta-Mendota Subbasin GSP development efforts.

The Merced Subbasin GSAs, which include members of the MIRWMA and other RAC members, are interested in coordinating with the Westside-San Joaquin Region on issues relating to subsidence near the boundary between the regions. Additionally, inter-regional coordination has been occurring via the DAC Involvement Program funding application; this application was prepared cooperatively among seven IRWM Regions in the San Joaquin River Funding Area and will include a Funding Area-wide DAC needs assessment.

15.3 Coordination with Other Agencies

Continued coordination with local agencies with permitting authority will be critical to the implementation of projects in the MIRWMP. In the Merced Region, the primary agency with permitting authority for water projects is the Merced County Environmental Health Division. Merced County is engaged in the IRWM program as a member of MIRWMA.

15.3.1 Coordination with Local and Regional Agencies

The Region's governance structure allows any interested party to apply to participate on the RAC, thereby encouraging coordination among local and regional agencies throughout the IRWM planning process. Other agencies or members of the public may also participate in the planning process by attending public workshops, submitting projects to the IRWMP, and by providing comments at the public meetings of the MIRWMA board. Further coordination with local agencies may occur as the MIRWMP is updated and current information from local agencies is incorporated into the MIRWMP in order to provide an accurate description of the Region. A key component of coordination with local and regional agencies also occurs via the Call for Projects, when agencies have the opportunity to submit projects to the MIRWMP. Multiple agencies may also coordinate to develop projects and submit them to the MIRWMP. As the Region works to prepare funding applications through the IRWM program, additional coordination will occur to determine applicants and included projects. Generally, when grant funding is received coordination would continue for the duration of the funded projects.

15.3.2 Coordination with State and Federal Agencies

The Region has identified the need for a streamlined permitting process for environmental enhancement projects which typically require extensive coordination with state and federal agencies. Historically, coordination with state and federal agencies has occurred on a local, project-specific basis as needed to complete necessary permits and CEQA or NEPA documentation. Individual project proponents will be responsible for coordinating with State and federal agencies on CEQA and/or NEPA compliance and permitting. Project proponents receiving grant funding may also be responsible for submitting data to statewide databases and coordinating with the agencies managing that data. Prior to project implementation, project proponents may need to coordinate with agencies such as USBR, California Department of Fish and Wildlife, California Department of Transportation, Office of Historic Preservation, USACE, and others.

The Merced Region has engaged in extensive coordination with DWR through Prop 84 grant processes as the Region has received funding through previous IRWMP funding solicitations. MIRWMA is currently coordinating directly with DWR through both the IRWMP process and the DAC Involvement Grant Program. MID has also coordinated with DWR relative to climate change as part of the FLOOD-MAR program. Further, Merced County, MID, and other agencies within the Region are working together on implementation of SGMA. Compliance efforts are underway for the Turlock, Merced, Delta-Mendota and Chowchilla groundwater subbasins. Finally, MIRWMA is also coordinating with SWRCB as it prepares the first SWRP for the Region.

Merced Integrated Regional Water Management Plan

Chapter 16 Climate Change

Chapter 16: Climate Change addresses both adaptation to the effects of climate change and mitigation of GHG emissions, and includes the following items as required by the IRWM Plan Climate Change Standard (DWR, 2016):

- ✓ A discussion of the potential effect 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 to those vulnerabilities. The evaluation of vulnerabilities must, at a minimum, be equivalent to the vulnerability assessment contained in the Climate Change Handbook for Regional Water Planning, Section 4 and Appendix B (CDM, 2011).
- ✓ A process that considers GHG emissions when choosing between project alternatives (provided in Chapter 6 Project Review Process).
- ✓ A list of prioritized vulnerabilities based on the vulnerability assessment and the IRWM's decision making process.
- ✓ A plan, program, or methodology for further data gathering and analysis of the prioritized vulnerabilities.

As discussed previously, 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 GHGs in the Earth's atmosphere. Changes in climate can affect 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.

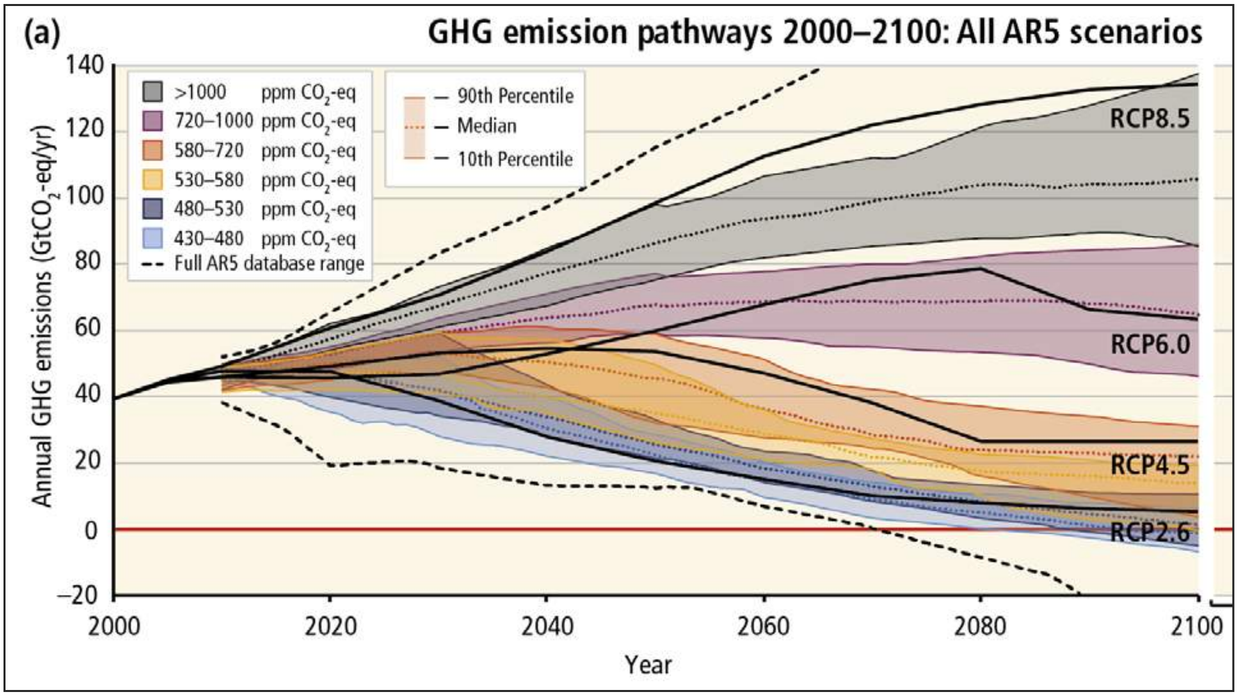
Planning for and adapting to anticipated changes in climate will be essential to ensuring water supply reliability for all users and to protecting sensitive infrastructure and habitats against more frequent and extreme precipitation and wildfire events. This chapter summarizes anticipated climate change impacts on the State of California and the Merced Region, evaluates the 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.

16.1 Statewide Observation and Projections

Indications of climate change have been observed over the last several decades throughout California. Statewide average temperatures have increased by about 1.7^{o}F in the last century, 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 (USEPA, 2016).

Multiple models have been developed and run to evaluate global and regional climate change impacts. General Circulation 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 Representative Concentration Pathways (RCPs) or scenarios for making projections based on population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy. The RCPs describe four different 21st century pathways of GHG emissions and atmospheric concentrations, air pollutant emissions and land use, and include a stringent mitigation scenario (RCP2.6), two intermediate scenarios (RCP4.5 and RCP6.0) and one scenario with very high GHG emissions (RCP8.5) (see Figure 16-1). Scenarios without additional efforts to constrain emissions ("baseline" or "business as usual" scenarios) lead to pathways ranging between RCP6.0 and RCP8.5. RCP2.6 is representative of a scenario that aims to keep global warming likely below 2°C above pre-industrial temperatures (IPCC, 2014).

Figure 16-1: IPCC Climate Change Scenarios



Source: IPCC, 2014

16.1.1 Temperature and Precipitation Changes

While California's average temperature has increased by over 1°F in the last one hundred years, trends are not uniform across the State (Moser et al., 2012). The Central Valley has actually experienced a slight cooling trend in the summer, likely due to an increase in irrigation (CEC, 2008). Higher elevations and Southern California have experienced the highest temperature increases. 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 °F – 3.6°F (CAT, 2009) and average temperatures will increase by 3.6°F – 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, 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. Rising temperatures that cause earlier snowmelt also contribute to this issue. This increased streamflow variability could lead to increased risks of flooding, levee failure, saline water intrusion and flood- or drought-induced habitat destruction.

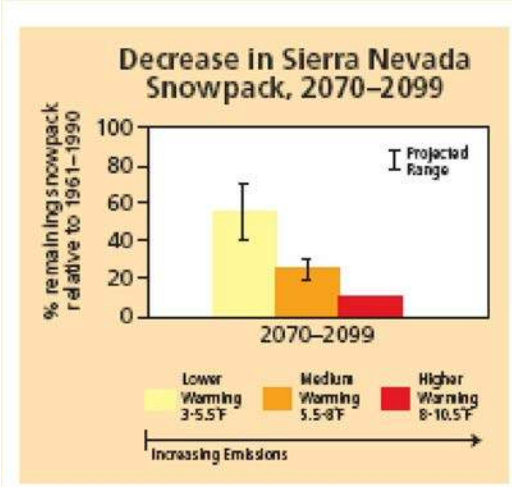
While temperature projections exhibit high levels of agreement across various models and emissions scenarios, projected changes in precipitation are more varied. Taken together, downscaled GCM results show little, if any, change in average precipitation for California before 2050 (DWR, 2006), with a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

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

In the last century, the California coast has seen a sea level rise of seven to eight inches (California Coastal Commission, 2018). 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 (see Figure 16-2), 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, with wildfires expected to continue to increase in both frequency and severity (CCSP, 2009).

Figure 16-2: Projected Snowpack Changes in the Sierra Nevada



Source: Hopmans et al. 2008

16.2 Legislative and Policy Context

The IRWM analysis of climate change impacts and corresponding response actions must be framed 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 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 AB 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, 2014, 2017)

AB 32 required CARB to prepare a Scoping Plan to identify and achieve reductions in GHG emissions in California. The AB 32 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. The first update to the Scoping Plan was approved by CARB in 2014. The 2014 update identified next steps for California to reduce GHG emissions beyond 2020 and reviewed the progress made to date. The 2017 update built on the programs established in previous scoping plans, focusing on achieving the interim goal of reducing emissions 40% below 1990 levels by 2030. This plan update proposes measures to strengthen major programs that have been successful in reducing the State's GHG emissions while further integrating efforts to reduce both GHGs and air pollution.

Senate Bill 97 (2007)

SB 97 recognized the need to analyze GHG emissions as part of the CEQA process. SB 97 directed the Governor's Office of Planning and Research to develop, and the Natural Resources Agency to adopt, amendments to the CEQA Guidelines to address the analysis and mitigation of GHG 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://resources.ca.gov/ceqa/). 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 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* 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 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 Climate Adaptation Advisory Panel 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 *2009 California Climate Adaptation Strategy* 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.

Safeguarding California: Reducing Climate Risk, An Update to the 2009 California Climate Adaptation Strategy (2014)

The California Natural Resources Agency prepared the *Safeguarding California Plan* as an update to, but not a replacement of, the 2009 California Climate Adaptation Strategy. The plan provides policy guidance for state decision makers, delineating climate risks in nine sectors in California and making recommendations within each sector. Within the water resources sector, the plan lists the following actions needed to prepare for climate risks:

1. Vigorously prepare California for flooding
2. Support regional groundwater management for drought resiliency
3. Diversify local supplies and increase water use efficiency
4. Reduce Sacramento-San Joaquin Delta climate change vulnerability
5. Prepare California for hotter and dryer conditions and improve water storage capacity
6. Address water-related impacts of climate change on vulnerable and disadvantaged populations and cultural resources
7. Continue to mainstream climate considerations into water management
8. Utilize low impact development and other methods in State and regional stormwater permits to restore the natural hydrograph
9. Require closer collaboration and coordination of land use and water planning activities to ensure that each reinforces sustainable development that is resilient to climate changes
10. Protect and restore water resources for important ecosystems
11. Better understand climate risks to California water and develop tools to support efforts to prepare for climate risks

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 (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 (2013)

The California Water Plan provides a collaborative planning framework for elected officials, agencies, tribes, water and resource managers, businesses, academics, 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 2013, the California Water Plan Update provided statewide water balances for 13 water years (1998 through 2010), demonstrating the state's water demand and supply variability. The updated plan built on the framework and resource management strategies outlined in the California Water Plan Update 2009 promoting IRWM and improved statewide water and flood management systems. The California Water Plan Update 2013 provided the following 17 objectives to help achieve the California Water Plan goals:

1. Strengthen integrated regional water management
2. Use and reuse water more efficiently
3. Expand conjunctive management of multiple supplies
4. Protect and restore surface water and groundwater quality
5. Practice environmental stewardship
6. Improve flood management using an integrated water management approach
7. Manage the Delta to achieve the coequal goals for California
8. Prepare Prevention, Response and Recovery Plans
9. Reduce the carbon footprint of water systems and water uses
10. Improve data, analysis, and decision-support tools
11. Invest in water technology and science
12. Strengthen Tribal/State relations and natural resources management
13. Ensure equitable distribution of benefits
14. Protect and enhance public access to the State's waterways, lakes, and beaches
15. Strengthen alignment of land use planning and integrated water management
16. Strengthen alignment of government processes and tools
17. Improve integrated regional water management finance strategy and investments

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 California Water Plan Update 2013 presents 30 resource management strategies to provide a range of choices and building blocks in addressing future uncertainty. Finally, the California Water Plan Update 2013 provides regional reports that summarize water conditions, provide a water balance summary, describe regional water quality, and describe water/flood planning and management on a hydrologic region basis. The regional summaries then provide a summary of challenges facing each of the hydrologic regions and provide future scenarios for the region.

The 2018 California Water Plan Update is currently being prepared.

Climate Ready Utilities (2010, 2015)

In the fall of 2009, the USEPA convened a Climate Ready Water Utilities Working Group under the National Drinking Water Advisory Council. This working group prepared a report that documents 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 – 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.

In 2015, the USEPA released an update to the report, entitled *Adaptation Strategies Guide for Water Utilities*. The guide is intended to provide adaptation options for drinking water, wastewater, and stormwater utilities. Utilities can use the information in the guide to identify the most relevant challenges to their specific region, and to develop an adaptation plan.

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.

Executive Order B-30-15 (2015)

In 2014, the IPCC released its Fifth Assessment Report which identified limiting global warming to 2°C or less by 2050 as necessary to avoid potentially catastrophic climate change impacts. In response to this assessment, Governor Edmund G. Brown, Jr. issued Executive Order B-30-15. This order established an interim GHG reduction goal (to be achieved prior to the established 2050 goal) of reducing GHG emissions to 40 percent below 1990 levels by 2030. This Executive Order also included guidance for state agencies regarding implementation and strategy.

16.3 Regional Climate Change Projections and Impacts

The Merced Region lies within the San Joaquin River Hydrologic Region and contains the San Joaquin River, Merced River, Bear Creek and Owens Creek. The Merced River watershed of 660,000 acres is the smallest of all watersheds contributing to the San Joaquin River upstream of the Delta. Approximately 122 miles of the Merced River are designated as Wild and Scenic; however, none of this designation applies to reach of the Merced River within the Region. MID owns two hydroelectric and three mini-hydro facilities in the Region with an online capacity of 115 megawatts. MID also owns two dams (New Exchequer Dam and McSwain Dam) with a total water storage capacity of over 1 million AF.

16.3.1 Recent Regional Studies and Research

At present, the Upper Merced River watershed is the focus of several research projects linked to the impacts of climate change on hydrology in the California Sierra Nevada. Examples of studies currently underway or recently completed include:

- Impacts of climate change on the Lyell and Maclure Glaciers in Yosemite National Park (Stock, 2015)
- Quantifying changes in glaciers in the Sierra Nevada (Fountain, 2011)
- The role of atmospheric rivers in extreme events in Northern California (USGS, 2018)
- Impacts of climate changes on soil properties and habitats in the Sierra Nevada (UC Merced and USGS)
- Study of the effects of climate change on hydrology and stream temperatures in the Sierra Nevada (Maurer, 2007)
- Impacts of climate change on hydrology and watershed in California's Sierra Nevada (Null et al., 2010)
- Impacts of climate warming on water supply reliability in the Tuolumne and Merced River Basins (Kiparsky et al., 2014)
- Impacts of climate change on MID (Dewberry, 2017)

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 yet available.

16.3.2 Regional Climate Change Projections

In general, regional climate change modeling simulations project temperature increases throughout California with significant uncertainty associated with future precipitation patterns and water supply projections statewide. In general, changes in precipitation correlate with changes in water supply, with decreased precipitation correlating to decreased stream flows and decreased groundwater percolation. A study conducted by the University of California, Davis Center for Watershed Sciences in 2010 (Null et al.,

2010) evaluated the hydrologic response and watershed sensitivity to climate change for the Sierra Nevada watersheds, including that of the Merced River. This study used a climate-forced rainfall-runoff model to explicitly simulate intra-basin hydrologic dynamics and understand localized sensitivity to climate warming. Using the Stockholm Environmental Institute's Water Evaluation and Planning System (WEAP21), the researches simulated anticipated 2°C, 4°C and 6°C temperature increases and evaluated changes from baseline for three key parameters – mean annual flow, centroid timing, and low flow duration – to highlight relative differential responses across the Sierra Nevada watersheds and in relation to water resource development (water supply, hydropower and mountain meadow habitat, respectively).

In more recent years, a similar study, published in January of 2014, also used the WEAP platform to present an integrated hydrology and water operations simulation model of the Tuolumne and Merced River Basins (Kiparsky et al., 2014). Like the 2010 study discussed above, modelers evaluated impacts and hydrological responses to 2°C, 4°C and 6°C temperature increases according to a historical baseline (1981 – 1999).

In October, 2017, MID released its own *Climate Change Impact Report* assessing how the irrigation district would be affected by climate projections (Dewberry, 2017). This analysis utilized a precipitation-runoff model from the MID Hydrologic and Hydraulic Optimization model. MID ran three future scenarios, evaluating responses to 3°C, 5°C and 10°C temperature increases. Therefore, the results simulate more dramatic climate change circumstances.

Although exact numerical results vary amongst the studies, the general conclusions of all three studies remain consistent. All studies found decreases in mean annual flow, a shift to an earlier snowmelt and runoff, a longer low flow duration, and an overall reduction in surface water reliability in the Merced River watershed.

Impacts on Mean Annual Flow

Both 2010 and 2014 studies found that modeled changes of climate warming in the Merced River watershed resulted in reductions in mean annual flow (MAF). Specifically, UC Davis's 2010 study found that there were approximately 3%, 6% and 8% decreases in mean annual flow on the Merced River resulting from 2°C, 4°C and 6°C increases in air temperature, respectively (Null et al., 2010). Kiparsky's 2014 study also determined that there were decreases in the magnitude of streamflow due to the effects of increased temperature (such as increased evapotranspiration) (Kiparsky et al., 2014). As shown in Table 16-1, model results from the 2014 study showed more dramatic percent decreases in streamflow magnitude than the 2010 study (4%, 8.5%, and 12% for 2°C, 4°C and 6°C increases, respectively).

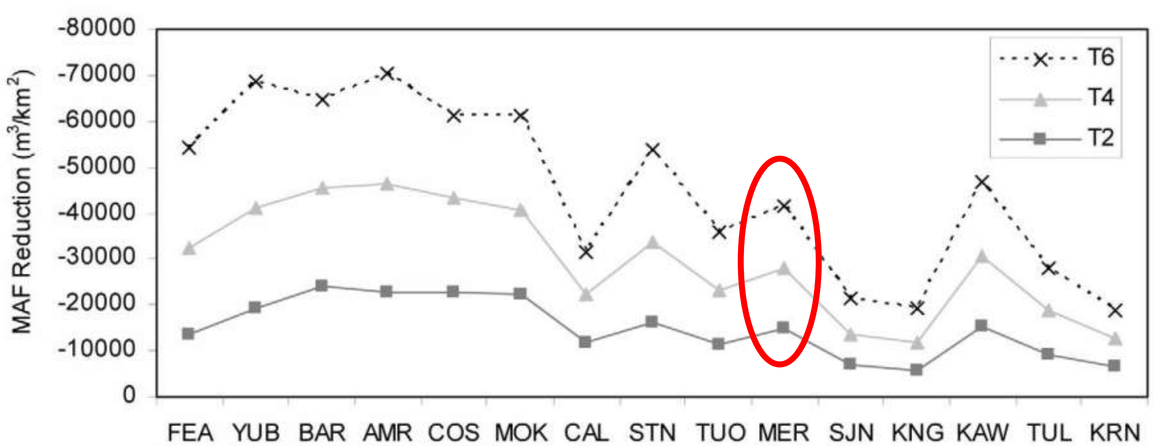
Table 16-1: Mean Annual Flow Projections (2014 Model)

Watershed	Historical MAF (10^6 m^3) (1981 – 1999)	Simulated MAF (10^6 m^3) (1981 – 1999)	Simulated MAF (10^6 m^3) (2ºC)	Simulated MAF (10^6 m^3) (4ºC)	Simulated MAF (10^6 m^3) (6ºC)
TUO	2,608	2,609	2,506 (-3.9%)	2,418 (-7.3%)	2,323 (-11%)
MER	1,363	1,361	1,303 (-4.3%)	1,245 (-8.5%)	1.195 (-12.1%)

Notes:
TUO – Tuolumne River Basin
MER – Merced River Basin
Percentages in parentheses indicate the percent decreases in magnitude of streamflow.
Source: Kiparsky et al., 2014

These reductions in mean annual flow impact instream conditions and habitat for aquatic and riparian ecosystems. As pictured in Figure 16-3, relative to other Sierra watersheds, the Merced River simulations experienced a moderate change in MAF due to climate change and was therefore considered to be less vulnerable to climate warming based on total water stored and changes in MAF than more northern watersheds (such as the American, Yuba, Bear, Mokelumne and Cosumnes Rivers) (Null et al., 2010).

Figure 16-3: Reduction in Mean Annual Flow from Base Case by Watershed

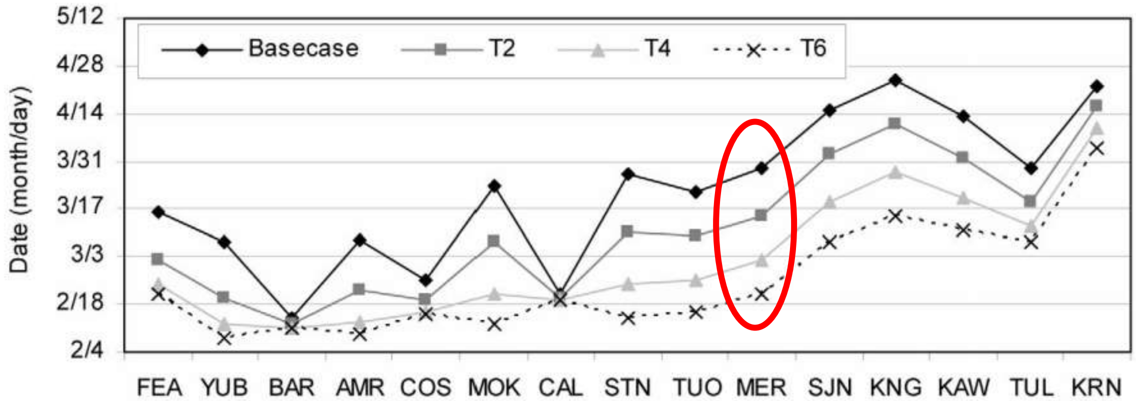


Notes:
MER – Merced River watershed
Source: Null et al., 2010

Impacts on Runoff Centroid Timing

The 2010 modeling results showed that runoff centroid timing (CT) was 2 weeks, 4 weeks, and 6 weeks earlier given the respective 2ºC, 4ºC and 6ºC increases in air temperature. These results are shown in Figure 16-4.

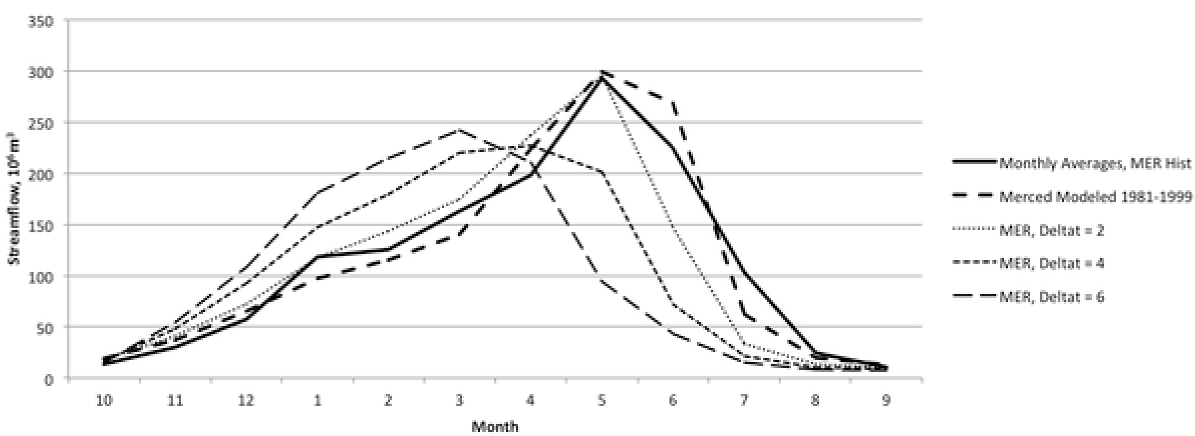
Figure 16-4: Average Annual Centroid Timing by Watershed



Notes:
MER – Merced River watershed
Source: Null et al. 2010

Kiparsky's 2014 study also found an earlier snowmelt and resulting shift of peak flows to earlier in the water year. This is demonstrated in Figure 16-5, which plots the streamflow results for the Merced River, as calibrated in response to the 2°C, 4°C and 6°C increases in temperature.

Figure 16-5: Simulated Streamflow for the Merced River (2014 Model)



Source: Kiparsky et al., 2014

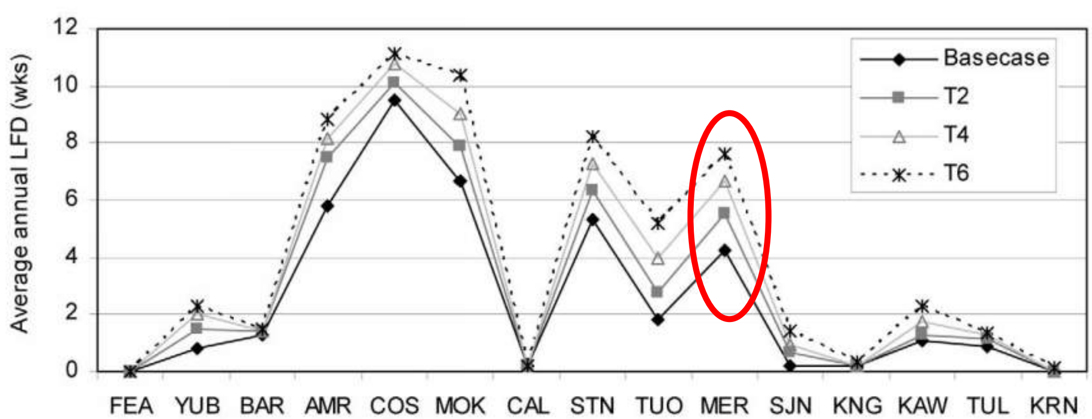
Finally, MID's impact report concurred with these results, finding large differences in the timing of peak flow with warming air temperatures. For the lowest temperature increase modeled ("T+3" scenario), peak discharge occurs at least one month earlier than the historical baseline. In addition, other impacts to runoff timing were observed. For example, the magnitude of precipitation events increased since higher air temperatures caused more precipitation to fall as rain rather than snow. This led to higher immediate runoff, which caused higher risks of flooding in the winter and early spring. Impacts on snowpack were also discussed; the snow water equivalent and snow-covered areas across the Merced River watershed were significantly reduced (Dewberry, 2017).

Change in seasonal runoff timing may affect electrical generation capabilities, flood protection, water storage and deliveries. Using online hydropower capacity as a measure of impact, watersheds that rely on hydropower generation may face substantial changes in runoff timing with climate warming. 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. While the Merced River demonstrated changes in CT due to climate warming, the limited generating capacity of the river (relative to that on other Sierra Nevada rivers) makes it one of the less vulnerable watersheds state-wide (Null et al., 2010).

Impacts on Low Flow Duration

The UC Davis 2010 study evaluated the average low flow duration (LFD) for the Sierra Nevada watersheds relative to climate change. For the Merced River, average low flow duration lasted 2, 3 and 4 weeks longer for the 2ºC, 4ºC and 6ºC increases in air temperature, respectively (see Figure 16-6, Null et al., 2010). Changes in LFD were considered a surrogate for montane ecosystems in the study as persistent low flow conditions deplete meadow groundwater reserves and soil moisture, reducing the downstream benefits of meadows. Meadows provide ecosystem services such as maintaining summertime flow during dry periods and reducing floods in winter; providing aquatic and riparian habitat for birds, fish, amphibians, and insects; promoting riparian vegetation rather than conifer or dry shrub vegetation that increases wildfire risks; and improving downstream water quality. Merced River was considered vulnerable to LFD. Along with Yosemite and its meadows upstream, the Merced River could experience habitat loss as a result of climate change (Null et al., 2010).

Figure 16-6: Average Annual Low Flow Duration by Watershed



Notes:
MER – Merced River watershed
Source: Null et al. 2010

Impacts on Surface Water Supply Reliability

In addition to the other climate change impact metrics discussed above, Kiparsky's 2014 study also modeled surface water supply reliability in the Merced River Basin. The study framed reliability as a function of changes in agricultural water demands and hydrology in relation to the modeled behaviors of existing storage, conveyance, and irrigation systems. For each temperature iteration, the "reliability metric" assigns a binary metric where a given time point is determined either to be a failure or success based on an established demand threshold. The reliability then represents a probabilistic measure of rate of success. The formula used in the 2014 study measures the degree of failure based on the amount of shortfall below the demand threshold. This metric is calculated where *i* represents a given demand point (or group of demand points), and *j* symbolizes timesteps:

$$R_{ij} = 1 - \frac{(Demand_{ij} - Delivery_{ij})}{Demand_{ij}} \textit{ if } Demand_{ij} \geq Delivery_{ij};$$

$$\textit{if not } R_{ij} = 1.$$

Overall, for the agricultural districts simulated, surface supply reliability is reduced with increasing temperature, driven in part by changes in streamflow. For MID, supply reliability decreased for each incremental increase in temperature (See Table 16-2). These results do not account for the potential for other physical (e.g. plant physiological response) or behavioral changes (e.g. changes in irrigation technology or cropping patterns) (Kiparsky et al., 2014).

Table 16-2: Modeled Supply Reliability at Major Irrigation Districts in the Merced River Basin

Irrigation District	DT = 0ºC	DT = 2ºC	DT = 4ºC	DT = 6ºC
Modesto Irrigation District	0.84	0.82	0.79	0.75
Turlock Irrigation District	0.86	0.85	0.82	0.79
Merced Irrigation District	0.90	0.86	0.81	0.75

Source: Kiparsky et al., 2014

16.4 Regional Water Resource Vulnerability

Primary water users in the Merced Region include urban users, agriculture, and the environment. Water supplies include both groundwater and surface water, with groundwater coming from the Merced (predominantly), Turlock and Chowchilla Subbasins of the San Joaquin Valley Groundwater Basin and surface water being diverted primarily from the Merced, Chowchilla, and San Joaquin 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 overdrafted in many 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 since capturing earlier runoff to compensate for future reductions in snowpack would take up a large fraction of the available flood protection space. This forces 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 2011 Climate Change Handbook outlines seven categories of key climate change vulnerabilities that are anticipated in California's water resources (CDM, 2011). These include:

- Water Demand
- Water Supply
- Water Quality
- Sea Level Rise
- Flooding
- Ecosystem and Habitat Vulnerability
- Hydropower

These identified vulnerabilities and their applicability to the Merced Region are summarized in Table 16-3 and further described in the following sections.

Table 16-3: Merced Region 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 exacerbating 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.
Sea Level Rise	Due to its inland location, sea level rise is not a direct potential climate change impact to the Merced Region.
Flooding	Vulnerable to 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.
Ecosystem and Habitat Vulnerability	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).
Hydropower	Vulnerable to increased customer demand combined with changes in timing of seasonal runoff and flashier storm systems affecting reservoir storage.
Other	Vulnerable to impacts on recreation and tourism industries (such as Yosemite National Park and ski resorts) that support the Region's economy.

16.4.1 Water Demand

Land use patterns in the Merced 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). In addition, groundwater salinity increases are projected due to conditions such as drier climate, increased groundwater pumping, and lower induced water tables (Schoups et al., 2010). The effects of increased air temperatures on agriculture will include faster plant development, shorter growing seasons, changes to reference evapotranspiration and possible heat stress for some crops. Without accounting for evapotranspiration rates, agricultural crop and urban outdoor demands are expected to increase in the Sacramento Valley by as much as 6% in the future (Chung et al., 2009). 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 Merced Region.

When more water is required to maintain yield and potentially reduced supplies available, the agricultural community may respond to these climate-induced changes 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 (Schoups et al., 2010). However, agricultural impacts resulting from climate changes are anticipated to be significant in the Region, as Merced County ranks 5th in the state in agricultural production with a value of over $3.4 billion (Merced County, 2017). For example, dairy production has the potential to be greatly impacted by changes in climate. Heat stress can have a variety of effects on livestock, including reduced milk production and reproduction in dairy cows (Valtorta, 2002). Models have found that rising temperatures could reduce milk production by 7% - 10% under the B1 scenario and by 11% - 22% under the A1 scenario (Hayhoe et al., 2004).

Based upon each urban water supplier's most recent UWMP and the Merced County General Plan Update, the anticipated total water demand in the Merced IRWM Region is anticipated to be 450,000 AF in 2040. Table 16-4 provides an overview of the total anticipated demands in 2040, categorized by demand type. For a more detailed breakdown of anticipated water demands through 2040, including the demand's corresponding jurisdiction, see Chapter 2 Region Description, Table 2-5.

Table 16-4: Anticipated Total Applied Water Demand in the Merced Subbasin in 2040

Demand Type	AF	Percentage of Total
Municipal[1]	81,398	18%
Agricultural[2]	369,653	82%
TOTAL	451,051	100%

Notes:
1. Demand based on data reported in most recent UWMPs for the City of Atwater (Boyle Engineering Corp., 2007), the City of Livingston (AM Consulting Engineers, 2016), and the City of Merced (Carollo, 2017). Unincorporated demands are based on the *Qualitative Comparison of Water Supply and Demands in Merced County Technical Memorandum* prepared for the Merced County General Plan Update (Nolte Associates, 2009).
2. Water demand projections assume the existing demands remain constant through 2040. Existing demands are based on the *Qualitative Comparison of Water Supply and Demands in Merced County Technical Memorandum* prepared for the Merced County General Plan Update (Nolte Associates, 2009), the MID AWMP (MID, 2016), and communication with Stevinson Water District (R. Kelley, personal communication, August 17, 2018).

Groundwater modeling completed for MID which indicated that groundwater demands are highest during dry years, likely due to the fact that groundwater is primarily used for agricultural irrigation (MID, 2016). The seasonal variability of water demands is projected to increase with climate change as droughts become more common and more severe (DWR, 2008). Other seasonal uses of water resources, such as landscape, irrigation, and cooling demands, are also expected to increase as a result of climate change (DWR, 2008). Identification of industrial cooling tower demands and the demands of similar facilities will help the Region gain better understanding of the potential increases in seasonal demands.

16.4.2 Water Supply and Quality

The Merced Region's water supplies include groundwater, local surface water, and imported surface water from the CVP in the case of CWD. In general, impacts on urban users will be a function of behavioral response of individuals and organizations as well as hydrology. Additional water storage will be required to ensure water supply reliability. Without additional storage, it will be difficult to capture and retain excess 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 use 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 will 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 Merced Region overlies three groundwater subbasins within the San Joaquin Valley Groundwater Basin as recognized by DWR in Bulletin 118 (*California's Groundwater*); these include the entirety of the Merced Subbasin and portions of the Chowchilla and Turlock Subbasins. According to the *Merced Groundwater Basin Management Plan Update*, groundwater elevations in the Merced Subbasin have been monitored by DWR, MID, and other entities since the 1950s (AMEC Geomatrix, Inc., 2008). This monitoring data demonstrates that, since 1980, average groundwater levels beneath the Merced Subbasin have declined, on average, approximately 14 feet, with most of this decline occurring between 1980 and 1996. As such, the Merced Subbasin is considered to be in a state of mild long-term groundwater level decline. In addition to dropping groundwater levels, the Merced Subbasin has high concentrations of TDS, generally at depths between 400 and 800 feet below the ground surface, that increase in concentration from east to west. The San Joaquin River acts as a natural saline barrier, so generally, TDS concentrations are greater on the west side of the River and less on the east side. Reduced streamflows in the San Joaquin River could reduce the effect of the natural barrier and allow for further migration of salinity in the groundwater basin. Additionally, climate change impacts may cause increased evapotranspiration and a longer growing season, further exacerbating groundwater overdraft and high salinity levels.

Portions of the groundwater subbasins are subject to high nitrate concentrations, elevated iron and manganese concentrations, and contamination with MTBE, DBCP and other contaminants which can impact the beneficial use of groundwater. Lastly, the variation in precipitation and streamflow in the future will influence how and when the groundwater subbasins are recharged in the Merced Region.

Surface Water Supply and Quality

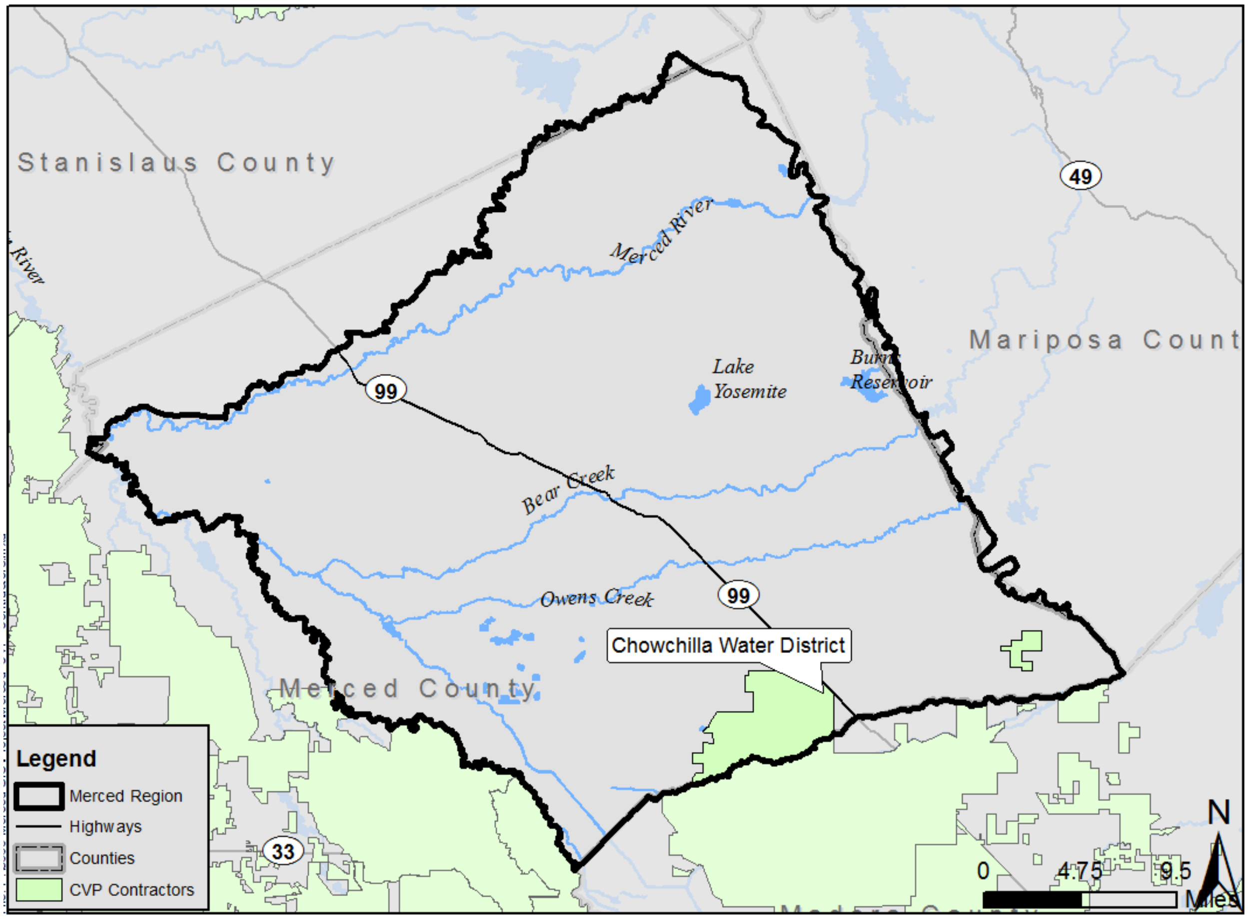
The CVRWQCB compiled the 303(d) list of impaired water bodies within the Sacramento River and San Joaquin River Basins that suffer significant water quality impairments from a variety of pollutants and must be addressed through the development of TMDLs. The Lower Merced River (from McSwain Reservoir to the San Joaquin River) is included on this list. Irrigated agriculture has been identified as a significant anthropogenic source of both 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 could pose significant challenges in implementing the defined TMDLs and meeting water quality goals.

As the occurrence of wildfires increases, additional sediment could be deposited into water bodies, and turbidity could 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, and the total annual runoff is projected to decrease by as much as 8.7% in San Joaquin watershed by 2050 (USBR, 2011). 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

As shown in Figure 16-7, less than 20% of the CWD service area lies within the Merced Region and it is the only portion of the Merced Region that receives imported water supplies via the CVP. Surface water supplies are delivered to CWD through contracts with the USBR that provides 24,000 AFY from Buchanan Dam and 55,000 AFY of Class 1 Water and 160,000 AFY of Class 2 Water from Friant Dam.

Figure 16-7: CVP Contractors within the Merced Region



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 USFWS released its final Biological Opinion on CVP and SWP Operations Criteria and Plan. In this Biological Opinion, USFWS determined that continued operation of these two water projects would likely adversely affect critical habitat for the delta smelt, a threatened species under the Endangered Species Act. Implementation of recommendations contained in this study has faced legal action, resulting in a 2010 district court ruling that the 2008 Biological Opinion was "arbitrary and capricious". Meanwhile, in 2014, the U.S. Court of Appeals for the Ninth Circuit reversed in part and affirmed in part the district court's judgement on the 2008 Biological Opinion (U.S. Court of Appeals for the Ninth Court, 2014). Long-term implementation of the USFWS's 2008 Biological Opinion could impact the long-term availability of CVP supplies.

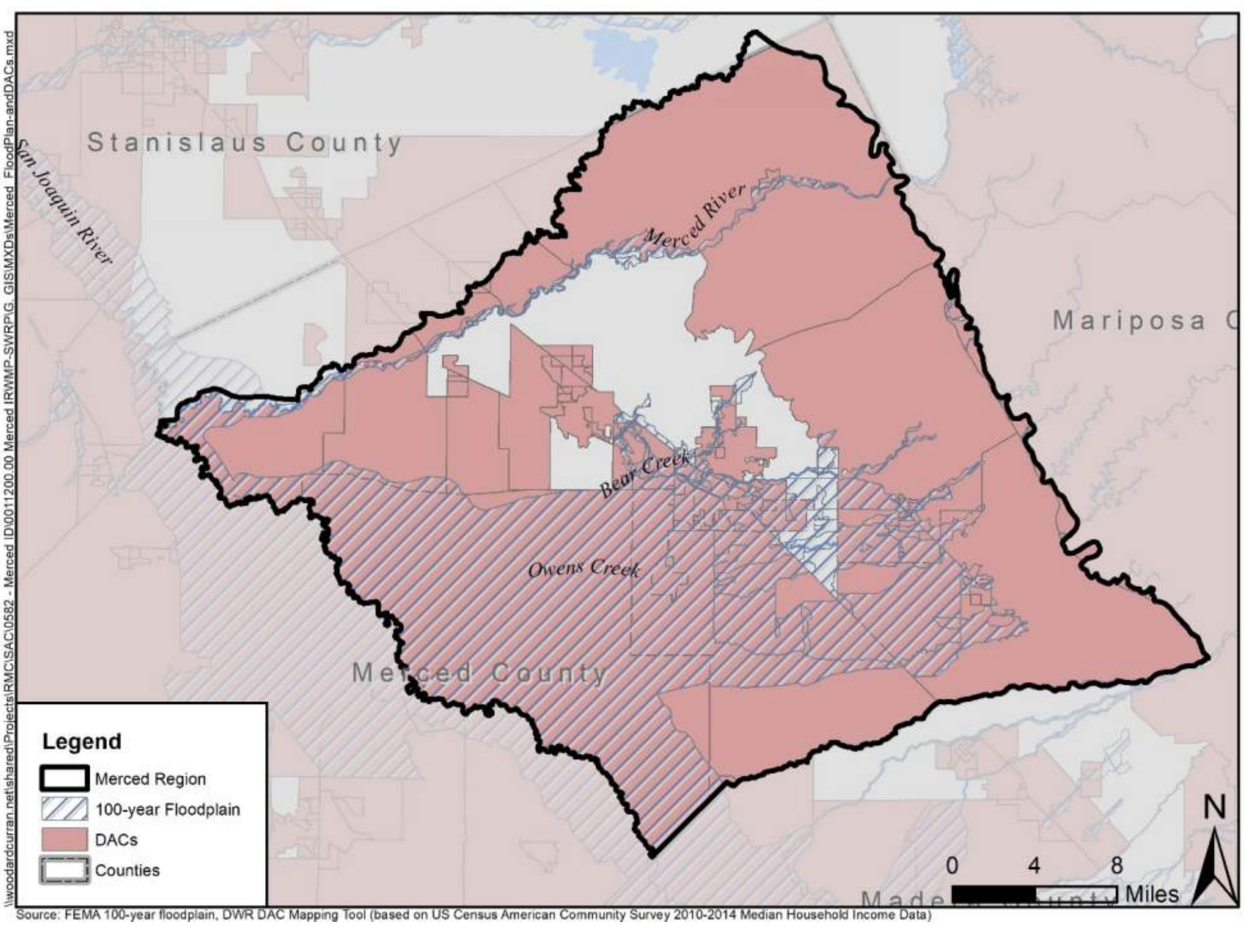
As a result of the increased temperature, DWR anticipates a 20% to 40% decrease in the state's snowpack by mid-century (DWR, 2008). This reduction in snowpack impacts the SWP, CVP and water systems that rely on the San Joaquin River and its tributaries. The SWP 2009 Delivery Reliability Report (DWR,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

16.4.3 Flooding

Sea level rise is not a direct potential climate change impact to the Merced Region. Sea level rise will result in increased coastal flooding; severity of non-coastal flooding will also increase in the future due to climate change. Changes in the amount, intensity, timing and variability of runoff, as well as 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. The Merced Region experienced three major flood events in recent years (1998, 2006 and 2017) that caused significant damage to homes, bridges, roads, and other structures, as well as geomorphic impacts to nearby creeks. These events could increase under anticipated future conditions.

There are significant portions of the Merced Region that lie within FEMA designated 100-year and 500-year flood zones. Low-lying DACs will be particularly vulnerable to flooding damages causing temporary and/or permanent displacement. Some of the DACs within the Merced Region lie within the 100-year floodplain as shown in Figure 16-8.

Figure 16-8: DACs within 100-year Floodplain



Source: FEMA 100-year floodplain, DWR DAC Mapping Tool (based on US Census American Community Survey 2010-2014 Median Household Income Data)

16.4.4 Ecosystem and Habitat

Eastern Merced County supports the largest unfragmented blocks of high-density vernal pool grasslands remaining in California. These vernal pools contain numerous rare and endangered species such as fairy shrimp, tadpole shrimp and several rate Orcutt tribe grasses (Economic & Planning Systems, Inc., 2009). These species and others that are susceptible to heat waves, droughts, and flooding may be in danger and invasive species may become even more challenging to manage (CCSP, 2009). Conservation efforts in the Region include work by UC Merced, in which the University placed the vernal pools and grassland reserve to the north and east of campus in the UC Reserve System in 2014, conserving a large block of vernal pool grasslands.

Climate change impacts on the environment within the Merced Region also include changes in vegetation distribution and increases in 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, decreases in precipitation will directly affect both surface water and groundwater quality. Warmer surface water will result in lower dissolved oxygen concentrations, which can directly impact aquatic and riparian habitats. Decreased precipitation and associated decreased groundwater percolation will result in increased dissolved concentrations of constituents in groundwater.

16.4.5 Hydropower

MID has generated wholesale electric power at its hydroelectric facilities for over 75 years. In 1967, McSwain and New Exchequer Dams were completed in Mariposa County, downstream of Lake McClure. The combined hydroelectric output for these two facilities is over 107 megawatts, and MID produces an average of approximately 330 million kilowatts per year (MID, 2018). Although the hydroelectric facilities and New Exchequer and McSwain Dams are outside the Merced regional boundary, they are operated by MID and currently provide power to the State's open grid. The Merced River Hydroelectric Project is operated to provide water supply, flood control, recreation and hydropower, and it is a component of MID's water portfolio. Power generation depends on gravity-driven water flow from the Lake McClure Reservoir into the New Exchequer powerhouse. Turbines then harness this gravity flow and create clean hydroelectric power. Within the past few years, MID also completed an upgrade to the McClure powerhouse which improved the process efficiency by 8 percent (MID, 2018).

Lake McClure and the Merced River 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).

16.4.6 Other

Climate change will also affect the Region in other ways, including impacting recreation and the tourism industries (and therefore the Region's economy). As one of the gateways to Yosemite National Park, the City of Merced and surrounding communities 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).

16.4.7 Prioritized Vulnerabilities

The Merced Region's vulnerabilities to anticipated climate changes were prioritized based on discussion with the RWMG and the RAC 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. Flooding
3. Hydropower
4. Water Demand
5. Ecosystem and Habitat Vulnerabilities

The rationale behind the prioritization acknowledges that the groundwater basin is already in overdraft condition and that increasing demands, combined with additional water supply reductions, will exacerbate this condition. Changes in the amount, intensity, timing, quality and variability of runoff (e.g. earlier springtime runoff and/or lower annual flows) will result in significant changes in river flows, potentially impacting both regional flooding and hydropower operations. Flooding and flood management is a major issue for the Region at present, and a flashier river/stream system is only going to worsen this condition. 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.

16.5 Strategies for 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 global circulation models (GCMs) are not available worldwide and are 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, 2012), where mitigation strategies include BMPs or other measures that are taken to reduce GHG emissions.

16.5.1 Climate Change Adaptation RMS

In accordance with the 2016 IRWM Guidelines (DWR, 2016), RMS are being considered in the Merced IRWM planning process to meet the Region's objectives. Application of various RMS diversifies water management approaches, and many of the RMS apply to climate change adaptation and mitigation. As a result, the Region has evaluated RMS in their ability to eliminate or minimize the vulnerabilities resulting from climate change, especially those impacting water infrastructure systems. Categories of applicable RMS include:

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

This section discusses each of these RMS categories and how each can be utilized to address to climate change impacts. This analysis was conducted as part of the Region's Climate Change Study (RMC, 2013d).

Reduce Water Demand

Reducing existing and future water demands can reduce pressure on water sources of limited supply and help the Region to 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.

Agricultural Water Use Efficiency

As discussed in Chapter 5, Section 5.4.1 Reduce Water Demand, the Merced Region is already implementing many agricultural water use efficiency efforts. For example, MID, the Region's primary agricultural water supplier, has identified and is currently implementing Efficient Water Management Practices as part of its AWMP (MID, 2016). The following are some of the Efficient Water Management Practices that MID is in the process of implementing:

- **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 Efficient Water Management Practices 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 Merced 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. In addition, 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 (MID, 2016; RMC, 2013d).

- **Water Management:** Water suppliers and users must take advantage of new technologies and hardware to optimize management of water-related infrastructure. 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 (MID, 2016; RMC, 2013d).

Urban Water Demand Reduction

DWR's *20x2020 Water Conservation 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 (DWR, 2010a); 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, 2010a; RMC, 2013d).

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 (CDM, 2011).

Through system reoperation, the Merced 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. For example, as discussed in Chapter 5, Section 5.4.3 Increase Water Supply, the City of Merced and MID are developing an MOU to formalize the exchange of tertiary-treated wastewater effluent from the City of Merced for surface water from MID. This will help the Region adapt to climate change by providing additional climate resilient water supplies. As such, transfers 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 is the amount of new supply created through regional water transfers (CDM, 2011; RMC, 2013d).

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 Merced 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 this RMS could include additional supply created, amount of potable water offset, and supply reliability (CDM, 2011).

Conjunctive Management and Surface and Groundwater Storage

MAGPI, the former Merced RWMG, developed and has been implementing the *Merced Groundwater Basin Groundwater Management Plan*, which promotes conjunctive surface water and groundwater management to improve the long-term sustainability of the Merced Groundwater Basin (AMEC Geomatrix, Inc., 2008). MAGPI was formed in 1997 (consisting of water purveyors in the Merced Groundwater Basin in addition to Merced County and EMRCD), recognizing the potential benefits regional planning would create when considering surface water and groundwater management in the basin. The Merced Region continues 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 from flooding and on 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 Merced Region adapt to the anticipated increased precipitation variability. 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 consider the potential to develop 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, and/or recycled 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 changing climate system (RMC, 2013d).

Desalination (Brackish and Sea Water)

Because the Merced 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 (RMC, 2013d).

Municipal Recycled Water Use

The *California Recycled Water Policy*, developed by the SWRCB 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 Merced 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 reductions in GHG emissions. Recycled water will continue to be used for agricultural purposes and urban landscape irrigation in the Region (Carollo, 2017), and expanded use will be encouraged and explored (RMC, 2013d).

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 water quality. These strategies may help the 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. 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 (RMC, 2013d).

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 (RMC, 2013d).

Pollution Prevention

In recent years, as point sources of pollution have become regulated and controlled, "non-point source" pollution has become a primary concern for water managers. Non-point source 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 non-point source pollution to existing surface and groundwater sources (DWR, 2013):

- Establish drinking water source and wellhead protection programs to shield drinking water sources and groundwater recharge areas from contamination.
- 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.
- Address improperly destroyed, abandoned, or sealed wells in these communities that may serve as potential pathways for contaminants to reach groundwater.

Public education can also reduce non-point source pollution to surface and groundwater sources. Protecting water supply sources will help to ensure that long-term sustainability of those supplies (RMC, 2013d).

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 2013* include (DWR, 2013):

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

As discussed in Chapter 5, Section 5.4.4 Improve Water Quality, the Region developed a salt and nutrient management plan as part of the Merced IRWM planning process. This plan identifies 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 (RMC, 2013b; RMC, 2013d).

Urban Stormwater Runoff Management

Urban stormwater 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 Merced Region should investigate and implement LID techniques and opportunities where appropriate and integrate urban runoff management with other RMS (RMC, 2013d).

Improve Flood Management

Increased frequency and severity of storm events will require the Merced Region to collaborate 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).

As discussed in Chapter 5, Section 5.4.5 Improve Flood Management, the Merced Region, as part of its IRWM planning process, completed an Integrated Flood Management Study to improve flood management. This study addresses flooding throughout the Merced Region and helps to identify strategies to implement to contribute to this RMS and help adapt to climate change impacts (RMC, 2013a).

Structural Improvement

Local flood jurisdictions should 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. Planning for structural projects should be integrated into a comprehensive integrated flood management program that takes a watershed approach (DWR, 2013; RMC, 2013d).

Disaster Preparedness, Response, and Recovery

The vulnerability assessment previously described in Section 16.4, Regional Water Resource Vulnerability, 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, 2013; RMC, 2013d).

Practice Resource Stewardship

Resource stewardship includes overseeing and protecting land, wildlife, and water by way of conservation and preservation, ecosystem restoration and forest management, 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). 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 Lands Stewardship

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 HCPs where appropriate.

This recommendation should be implemented over the long-term as each county general plan is updated (CDM, 2011; RMC, 2013d).

Ecosystem Restoration

Climate change is predicted to further fragment, stress and shrink California's ecosystems. Appropriate corrective actions should be designed to expand and reconnect them, preventing or reversing 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 (RMC, 2013d).

Forest Management

Although local water agencies that comprise MIRWMA, the Merced 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; RMC, 2013d).

Land Use Planning and 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.

Local land use agencies should not allow new critical public facilities, meaning those facilities that are required to maintain public health and safety, 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, 2013; RMC, 2013d).

People and Water

Climate change can be a polarizing and confusing topic that is difficult to communicate to many people. Oftentimes, the public can view climate impacts as global rather than local. Regardless of how these environmental issues are perceived, water management systems are vulnerable to and are being affected by ongoing changes in climate. Therefore, outreach and engagement are vital aspects of society's process of adapting to these impacts. This RMS is critical to improving communications between different groups of people and public agencies about the importance of climate adaptation and mitigation efforts. Promoting the benefits of improving air quality, public health, and water supply reliability is a significant part of encouraging public acceptance and investment in mitigation activities. In addition, water-dependent recreation will need to evolve as the climate changes. Due to increased temperatures, more people may seek water-dependent recreation for cooling. Meanwhile, increased variability in precipitation patterns will affect the quality of recreational water bodies, and armoring of coastlines due to sea level rise may pose safety risks and affect recreational access to beaches (DWR, 2013; RMC, 2013d).

Other Strategies

Additional conservation and demand reduction measures, such as crop idling, irrigated land retirement, and rainfed agriculture, could be implemented as climate change adaptive management strategies under this RMS (RMC, 2013d).

16.5.2 Applicability of RMS to Climate Change Adaptation

In order to further understand the potential synergies between the Region's RMS and climate change, the 2011 Climate Change Handbook outlines eight areas of climate change adaptation that must be considered to establish overall system resiliency (CDM, 2011). These include:

- Habitat Protection
- Flood Control
- Water Supply Reliability
- Additional Water Supply
- Water Demand Reduction
- Sea Level Rise
- Water Quality Protection
- Hydropower

The Climate Change Handbook then uses a table to demonstrate the overlap between these areas of climate change adaptation and RMS. This table is replicated and customized for the Region in Table 16-5, representing the overlap between climate change adaptation and individual RMS deemed appropriate for the Region. As more vulnerability tools and assessments are developed related to the impacts that climate change may have on water resources, additional adaptation strategies will be identified to address the potential region-specific impacts of climate change.

Table 16-5: Applicability of RMS to Climate Change Adaptation

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Water Quality Protection	Hydropower
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		✓	✓	✓		✓	
Municipal Recycled Water			✓	✓			
Surface Storage - CALFED	✓	✓	✓	✓		✓	✓
Surface Storage-Regional/Local	✓	✓	✓	✓		✓	✓
Improve Water Quality							
Drinking Water Treatment and Distribution			✓	✓		✓	
Groundwater Remediation/Aquifer Remediation			✓	✓		✓	
Matching Water Quality to Use			✓	✓		✓	
Pollution Prevention	✓		✓			✓	
Salt and Salinity Management	✓		✓	✓		✓	
Urban Stormwater Runoff Management	✓	✓				✓	

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Water Quality Protection	Hydropower
Improve Flood Management							
Flood Management	✓	✓				✓	✓
Practice Resource Stewardship							
Agricultural Lands Stewardship	✓	✓			✓	✓	
Ecosystem Restoration	✓	✓	✓			✓	
Forest Management	✓	✓	✓			✓	
Land Use Planning and Management	✓	✓				✓	
Recharge Area Protection		✓	✓	✓		✓	
Sediment Management	✓	✓	✓			✓	✓
Watershed Management	✓	✓	✓	✓		✓	✓
People and Water							
Economic Incentives	✓	✓	✓	✓	✓	✓	✓
Outreach and Engagement	✓	✓	✓	✓	✓	✓	✓
Water and Culture	✓				✓	✓	
Water-Dependent Recreation	✓	✓	✓			✓	
Other Strategies							
Crop Idling for Water Transfers			✓	✓	✓		
Irrigated Land Retirement			✓		✓		
Rainfed Agriculture					✓		

Source: Adapted from the Climate Change Handbook for Regional Water Planning (CDM, 2011).

16.5.3 "No Regret" Strategies

In addition to RMS, the Region also identified "No Regret" adaptation strategies that address climate change impacts. "No Regret" strategies are practices that make sense for the current water management context and conditions while also providing benefits in the context of future projected conditions caused by climate change. As a result, the Region either is already implementing or planning to implement its "No Regret" strategies.

Table 16-6 summarizes which RMS deemed appropriate for the Region overlap with “No Regrets” strategies for the Region.

Table 16-6: No Regret Strategies in the Merced Region

Resource Management Strategies	No Regrets Strategy
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 – 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	✓
Improve Flood Management	
Flood Risk Management	✓
Practice Resource Stewardship	
Agricultural Lands Stewardship	✓
Ecosystem Restoration	✓

Resource Management Strategies	No Regrets Strategy
Forest Management	
Land Use Planning and Management	✓
Recharge Area Protection	✓
Sediment Management	✓
Watershed Management	✓
People and Water	
Economic Incentives	✓
Outreach and Engagement	✓
Water and Culture	
Water-Dependent Recreation	
Other Strategies	
Crop Idling for Water Transfers	
Irrigated Land Retirement	
Rainfed Agriculture	✓

16.5.4 GHG Reduction Strategies

Table 16-7 (adapted from the California Water Plan Update 2009) identifies GHG reduction opportunities associated with each RMS deemed appropriate for the Region. Many of these RMS reduce energy consumption, especially the energy embedded in water, which ultimately reduces GHG emissions. Reducing GHG emissions will help the Region contribute to climate change mitigation. Additionally, Merced County recently partnered with The Nature Conservancy on a Land Management and Multi-Benefit Assessment project. This project developed a tool for County land use planning to assess the climate and GHG reduction benefits achieved through a variety of land use, land management and conservation activities. This tool can be used in the future to estimate benefits related to a range of RMS.

Table 16-7: RMS and GHG Reduction Opportunities

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
Reduce Water Demand	Agricultural Water Use Efficiency Urban Water Use Efficiency	Reducing water demands will reduce groundwater pumping demands, which result in GHG emissions.

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
Improve Operational Efficiency and Transfers	Conveyance – Regional/local System Reoperation Water Transfers	Improving operational efficiencies can improve the overall efficiency of the Region's water systems, thereby reducing cumulative energy demands and GHG emissions.
Increase Water Supply	Conjunctive Management & Groundwater Municipal Recycled Water Surface Storage - CALFED Surface Storage – Regional/Local	Localize water use, and efficiently reuse water to reduce groundwater pumping requirements and associated GHG emissions.
Improve Water Quality	Drinking Water Treatment and Distribution Groundwater Remediation/Aquifer Remediation Matching Water Quality to Use Pollution Prevention Salt and Salinity Management Urban Stormwater Runoff Management	Stabilize water cycles by conserving water systems to their natural state.
Improve Flood Management	Flood Management	Controlling flooding in a holistic watershed-based nature will potentially reduce the need for construction of intensive flood control systems. This will reduce energy and associated GHG emissions that would be required for construction.
Practice Resources Stewardship	Agricultural Lands Stewardship Ecosystem Restoration Forest Management Land Use Planning and Management Recharge Area Protection Sediment Management Watershed Management	Provide opportunities for carbon sequestration, reforestation, and reduce climate change impacts by restoring/maintaining land surfaces.
People and Water	Economic Incentives (Loans, Grants and Water Pricing)	Establishing economic incentives and educating the public on the impacts of GHG emissions can encourage

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
	Outreach and Engagement Water and Culture Water-Dependent Recreation	reduction in water use and an associated reduction in energy use.
Other	Crop Idling for Water Transfers Irrigated Land Retirement Rainfed Agriculture	Reduce energy requirements and GHG emissions from decreased groundwater pumping demands.

Source: Adapted from the California Water Plan Update 2009 (DWR, 2009).

16.5.5 Plan for Further Data Gathering

Identifying and implementing appropriate adaptation strategies requires having the 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 Merced Region has developed a data gathering and analysis approach to collecting and assimilating data related to the prioritized climate change vulnerabilities.

As an umbrella document, the Merced IRWM Plan is intended to coalesce and build upon available planning information and studies, not supersede them. Currently, significant data collection efforts are underway at the state, national, and international levels by agencies including DWR, CARB, the USEPA, and the IPCC among others. In order to ensure that the Merced Plan is responsive to projected climate change impacts and prioritized vulnerabilities, it will be critical to assimilate the data and information being collected through these avenues into future Plan updates. Further, a variety of project-specific data and information will be collected as part of the project performance and monitoring program. These data could contribute additional information on climate change information on the regional level that could be used to augment information developed at the state and national levels.

In conjunction with future Merced IRWM Plan updates, the available body of climate change information, data, and literature will be evaluated and incorporated into the vulnerability analysis and throughout the Plan, as appropriate. In addition, the data collection tables completed in support of the Plan-level and project-level monitoring will be revised, as appropriate, to include additional climate change parameters. Further, the data management system (DMS) being developed for the Merced GSP (Opti DMS) may be used to track data that supports analysis of climate change impacts. This DMS could be augmented to allow for the visualization of data held in local databases, such as WISKI, Envision Connect, and Microsoft Excel spreadsheets, and can be expanded and augmented to allow for local control of data, continued use of legacy data systems, and data dissemination and use. Future planning efforts will determine precisely how the Opti DMS may be utilized to support the gathering and analysis of climate change data.

At a minimum the following data collection and analysis actions will be implemented as part of future plan updates to ensure that the plan adequately addresses prioritized climate change vulnerabilities:

- Review statewide available data at the following sites:
    - DWR IRWM Climate Change Document Clearinghouse – http://www.water.ca.gov/climatechange/docs/IRWM-ClimateChangeClearinghouse.pdf

- DWR's Climate Change Website – https://water.ca.gov/Programs/All-Programs/Climate-Change-Program
- Climate Change Handbook – http://slowatershedproject.org/reports/slo-county/US-EPA-Climate-Change-Handbook-for-Regional-Water-Planning.pdf
- State of California Climate Change Portal – http://www.climatechange.ca.gov
- CARB website – http://www.arb.ca.gov/cc/cc.htm
- The California CAT website – http://climatechange.ca.gov/climate_action_team/index.html
- CEQA Greenhouse Gas Analysis Guidance for DWR Grantees – http://www.water.ca.gov/climatechange/docs/Guidance%20For%20Grantees-%20Calculating%20GHGs%20for%20CEQA2011.pdf
- Association of Environmental Professionals. 2007. Alternative Approaches to Analyzing Greenhouse Gas Emissions and Global Climate Change in CEQA Documents. https://www.counties.org/sites/main/files/file-attachments/aep_global_climate_change_june_29_final1.pdf
- California Climate Action Registry. (2009). General Reporting Protocol Version 3.1. https://sfenvironment.org/sites/default/files/fliers/files/ccar_grp_3-1_january2009_sfe-web.pdf
- California Climate Adaptation Planning Guide – http://resources.ca.gov/climate/safeguarding/local-action
- Center for Biological Diversity. 2007. The California Environmental Quality Act on the Front Lines of California's Fight Against Global Warming. http://www.biologicaldiversity.org/publications/papers/CBD-CEQA-white-paper.pdf

- Review national and international data at the following sites:
  - U.S. EPA. 2009. Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2007. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2007
  - World Resources Institute and World Business Council for Sustainable Development. N.d. The Greenhouse Gas Protocol for Project Accounting. http://www.wri.org/publication/greenhouse-gas-protocol-0

- Update plan performance monitoring and project-specific monitoring data collection tables to include climate change parameters as appropriate.

Chapter 17 References

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MIRWMA

Merced Integrated Regional Water Management Authority

2018 Merced Integrated Regional Water Management Plan Update

FINAL

February 2019

APPENDICES

PREPARED BY

WOODARD & CURRAN

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Appendix A – Regional Advisory Committee Charter

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Merced IRWM Program
Regional Advisory Committee (RAC) Charter

October 2018

This document is intended to establish rules and guidelines for the Regional Advisory Committee (RAC) for the Merced Integrated Regional Water Management (IRWM) planning process and Stormwater Resources Plan (SWRP) development process. The RAC is a fundamental component of governance for the Merced IRWM Program and regional stormwater resources planning.

Table of Contents

1. Purpose

The Merced IRWM Program was established in 2009 by the Regional Water Management Group (RWMG), at the time comprised of the Merced Irrigation District, City of Merced, and Merced County. The Region completed its first IRWMP in 2013 based on the California Department of Water Resources (DWR) 2012 Proposition 84 IRWM Guidelines. Following the release of updated Proposition 1 IRWM Guidelines in 2016, the Region began preparing an update to the Merced IRWMP. Concurrently, the Region is preparing a Stormwater Resources Plan (SWRP). In 2016, the cities of Atwater and Livingston were added to the RWMG and the five agencies together formed a Joint Powers Authority (JPA), the Merced Integrated Regional Water Management Authority (MIRWMA). MIRMWA functions as the RWMG for the Merced Region, with its Board of Directors having decision-making authority on matters related to the IRWMP and SWRP. MIRWMA also has a Management Committee, which consists of staff who play a day-to-day role in managing the IRWMP and SWRP programs.

The RAC is an advisory body which provides recommendations to MIRWMA on topics related to the IRWM Program and stormwater resources planning. MIRWMA gives primary consideration to the recommendations of the RAC and incorporates the RAC's recommendations into documents prepared for presentation to the MIRWMA governing bodies. The RAC was originally formed in April 2012 to assist the RWMG (prior to the formation of MIRWMA) with completion of the Merced IRWMP and prioritization of projects for a Proposition 84 funding application. Since its formation, the RAC has continued to serve as an advisory body, providing recommendations to MIRWMA on key issues related to IRWM planning and funding applications, and now stormwater resources planning as well. The RAC and MIRWMA have established the following purpose for the RAC:

- Represent the broad interests and perspectives in the region.
- Assist in the implementation and revision of the Merced IRWMP and preparation and implementation of the Merced SWRP.
- Encourage cooperative planning among various aspects of water resources management in the Merced Region.
- Foster constructive, meaningful discussion of regional water management issues and needs, goals and objectives, plans and projects, and future funding and governance.
- Advise MIRWMA and the governing bodies on these topics.

This charter documents the establishment of the RAC, sets forth RAC member composition, duties, and responsibilities, and outlines organization and operation of the group. Throughout this document, references to IRWM planning and the IRWMP also include stormwater resources planning and the SWRP, as both these efforts fall under MIRMWA's purview and the broad definition of integrated water management for the Region.

2. Role of the Regional Advisory Committee (RAC)

The role of the RAC overlaps with the Purpose of the RAC listed in Section 1 above. The general role of the RAC is as follows:

a. Communicating regional perspectives to MIRWMA
b. Representing regional perspectives as the Merced IRWMP and SWRP are developed and implemented (e.g., by providing comment on draft documents)
c. Sharing knowledge among the RAC and MIRWMA members as appropriate to facilitate cooperative planning
d. Providing insight on regional water management issues and goals, plans, and projects, and the implementation of those items

As an advisory body to MIRWMA , the RAC is also specifically tasked with advising MIRWMA on certain topics. The RAC works closely with MIRWMA to develop recommendations for the following:

a. Adopting updates to the IRWMP for the Merced Region.
b. Establishing criteria for prioritizing projects to be submitted for IRWM grant programs.
c. Reevaluating projects submitted for grant funding, when necessary.
d. Approving and submitting grant applications.

When necessary, workgroups will be formed to meet separately and work on an issue or topic that cannot readily be resolved in the broader RAC setting.

3. Meetings

RAC Meetings

RAC meetings will be conducted on a quarterly basis or as-needed. During updates of the IRWMP, for example, the RAC may meet more frequently, such as on a monthly basis. Conversely, there could be instances where a quarterly meeting may not be needed and would be cancelled. If applicable, RAC meetings shall be noticed in accordance with the Brown Act. The RAC Chair coordinates Brown Act noticing. If desired by RAC Members, additional RAC meetings may be scheduled and noticed at least one week in advance.

Meetings shall be conducted in accordance with this Charter. The RAC Chair or Vice Chair will determine if a quorum exists at any RAC meeting. Formal voting may not occur without a quorum of RAC members; however, presentations and discussion of agenda topics may occur.

A quorum shall be defined as having at least one representative from 6 of the 10 RAC caucuses in attendance.

Workgroup Meetings

Workgroups are convened as needed by the Management Committee (staff from the MIRWMA member agencies who manage the IRWMP and SWRP on a day-to-day basis) with input and participation by the RAC. Workgroup meetings shall be conducted in accordance with this Charter. There are no quorum requirements for Workgroup meetings. Workgroups are not subject to Brown Act requirements and may not be publicly noticed in advance. Every effort will be made to post workgroup meetings in advance on the Merced IRWM website (www.merceirwmp.org).

Results of Workgroup meetings will be reported to the RAC at the next scheduled RAC meeting.

4. RAC Member Composition

There are ten membership categories (herein referred to as caucuses) for voting members of the RAC. These caucuses include Agriculture, Business (non-agricultural), Natural Resources/Watersheds, Disadvantaged Communities/Environmental Justice, Land Use, Water/Wastewater Management, Academic/Educational, Civic, Recreation, and At Large. The RWMG representatives participate as ex officio (non-voting) members of the RAC. State, federal, and regional agencies and organizations may also participate as non-voting members. The following is a general overview of the composition of each caucus. **Attachment A** provides a detailed description of the RAC Member Composition.

Membership Categories (Caucuses)	**Maximum Number of Representatives**
1. Agriculture: Representatives of dairy, ranching, and commodity farming, including large and small operations, row and tree crops.	4
2. Business: Representatives of food processing and other industrial activities, commercial enterprises, and building and real estate, including chambers of commerce and business associations (banking participation is important).	4

3. Natural Resources and Watersheds: Organizations focused on preserving, enhancing, and managing natural resources and watersheds, including fisheries and wetlands.	4
4. Disadvantaged Communities/Environmental Justice: Representatives of disadvantaged neighborhoods and small communities with water management challenges (rural and urban).	2
5. Land Use: Representatives of land planners (or assessor), planning commissions, and land use advocates.	3
6. Water/Wastewater Management: Public agencies and private entities that are not members of the RWMG and have statutory authority to supply municipal or irrigation water, manage wastewater, or provide flood control in the region.	3
7. Academic/Educational: Representatives of K-12 and college/university educators and academics.	2
8. Civic: Representatives of community organizations, including community service, good government, and taxpayer interests.	2
9. Recreation: Representatives of fishing, boating, birding, and park interests.	2
10. At Large Members: Other agencies and entities with interest in and/or impact on water resource management.	4
11. Non-Voting Members: RWMG members and State, Federal, and regional agencies and organizations who are interested parties.	5 RWMG, plus other agencies

All RAC members must be knowledgeable in the field or interest that they represent. As such, RAC members must represent a public agency, non-governmental organization, professional organization, academia, or business. In addition, the overarching goals for RAC membership are for the RAC to be geographically diverse, to represent multiple stakeholders, and to be approximately balanced between public agencies and non-profits.

5. RAC Member Attributes and Duties

The following are desired attributes for RAC members and their alternates:

1. Have knowledge and experience in water resources management.
2. Represent an agency, organization, tribe, academia, or interests that are under-represented in the region (e.g., disadvantaged communities or unincorporated areas).
3. Have the ability and desire to objectively articulate the perspective of his/her RAC seat and caucus at a level beyond that of his/her individual organization.
4. Provide recommendations with the best interests of the entire Merced IRWM region in mind.

In relation to attribute 3 listed above, RAC members are grouped into ten caucuses, each of which has specific seats that are outlined in **Attachment A**.

The following are general duties for which RAC members and their alternates are responsible:

1. Attend meetings consistently – participation in 75% of the meetings annually is the minimum expectation.
2. Come prepared – review materials ahead of time and provide comments as appropriate.
3. Be responsive to requests between meetings.

4. Act as a point of contact within his/her individual organization for collection and dissemination of information related to the IRWM Program.
5. Disseminate information about the IRWM Program to his/her contacts, as appropriate.
6. Designate an alternate to attend and participate in RAC meetings in his/her absence.
7. Recuse him/herself from discussion and voting if he/she has a personal interest or stake in the outcome.

RAC members and their alternates are subject to recusal due to conflicts of interest in accordance with *Government Code Title 9, Political Reform; Chapter 7, Conflicts of Interest.* A conflict of interest is defined as a RAC member using his/her position to influence IRWM program decisions in which he/she has a financial interest (§87100). Recusal will occur per the discretion of MIRWMA, in consultation with the RAC Membership Workgroup described in Section 8.

All Workgroup members are also expected to display the attributes and duties listed above. The recusal policy also applies to ad-hoc Workgroup members.

6. RAC Member and Alternate Terms

RAC members and their alternates will serve three-year terms, with one-third of the RAC membership terms ending in each year. RAC member and alternate terms do not apply to the non-voting members (including the RWMG). Upon selection of the RAC membership, the members (and their alternates) will be randomly selected for one-, two-, or three-year terms. All subsequent RAC members will serve three-year terms with one-third of the RAC membership terms ending each year. There is no limit to the number of terms served (consecutive or otherwise).

Beginning in 2019, RAC member terms will begin and end on March 1 each year. The RAC member selection process will typically occur in January and February.

7. RAC Member Replacement

A portion of the RAC membership will be replaced each year in February. As outlined in Section 6, terms for one-third of the RAC membership shall expire every year, however, there are no term limits. RAC member replacement shall occur via the process outlined below:

1. MIRWMA will solicit interest from all IRWM stakeholders, including RAC members whose terms are expiring. If chosen, the RAC may use an application process. **Attachment B** of this document contains the RAC Application that will be accepted from January 1st through 31st.
2. A RAC Membership Workgroup will be convened to develop recommendations for RAC member replacement. The Workgroup will be comprised of 8 members of the RAC whose terms are not expiring (to avoid self-appointments), with no more than one representative of each voting caucus. The full RAC shall identify the 8 members of the Membership Workgroup at a regular RAC meeting, no later than December of each year. Members of the Management Committee may participate as non-voting members of the Membership Workgroup.
3. The Membership Workgroup will establish the application solicitation process with support from the Management Committee, which will receive and distribute the applications for the Membership Workgroup. The Workgroup will review the RAC member applicants to confirm that they meet the RAC Member Composition stipulated in **Attachment A**.
4. If MIRWMA does not receive applications to fill each open seat on the RAC, the Management Committee will reopen the application period for one week and the Workgroup meeting will be delayed.
5. The Workgroup representatives may distribute the list of applicants to the voting caucuses and work with the caucus members to develop a recommendation for the new members of their caucus, if desired.

6. In February, the Workgroup will meet to review the applicants and provide a recommendation to the MIRWMA Board of Directors on the RAC membership. The recommendation must be specific enough to ensure that RAC membership is retained as specified in the RAC Member Composition in Attachment A. If the Workgroup cannot reach a consensus recommendation, it will inform the MIRWMA Board of Directors of this situation.
7. The MIRWMA Board of Directors will review the recommendation. If the RAC membership recommendation is not approved, the MIRWMA Board of Directors will refer it back to the RAC Membership Workgroup with specific requests for revision. Applicants will be notified by MIRWMA of their appointment to the RAC, and at that time will be asked to appoint a permanent alternate who is suitable to participate on the RAC under the member composition guidelines described in Attachment A. RAC members selected by the Workgroup will be assigned a three-year term.
8. The new RAC membership will be effective on March 1st.

Each RAC Membership Workgroup will remain in place throughout the year to address any membership issues that arise over those two years, including replacement of a member who retires or resigns.

8. Member and Alternate Attendance

All RAC members and their alternates are required to sign the RAC Attendance Policy document (refer to **Attachment C**), which stipulates that members are expected to participate in at least 75% of the RAC meetings each year. If RAC members cannot be present during a meeting or meetings, their alternates are expected to fill the RAC member's position without interruption to the RAC.

At the end of each calendar year, the RAC Membership Workgroup will review attendance of each RAC member and their alternates over the past 12 months to determine if they are in compliance with the RAC Attendance Policy. At the last RAC meeting of each calendar year, the RAC Membership Workgroup will present its attendance findings to the RAC, which will be responsible for deciding if members are in violation of the RAC Attendance Policy and therefore should be replaced as stipulated in Section 8.

9. Member Termination

In the event that MIRWMA and the RAC determine that a RAC member is not complying with the RAC member attributes and duties in Section 5, termination of that person's membership will be discussed by the RAC Membership Workgroup in closed session. The RAC Membership Workgroup may recommend termination and replacement to the full RAC, which will review the recommendation and inform the person of their termination. Replacement of that person will also be recommended by the RAC Membership Workgroup and approved by the MIRWMA Board of Directors.

10. RAC Chair and Vice Chair Roles

The RAC Chair and Vice Chair must be RAC members.

Although not required, the following attributes are desirable for the Chair and Vice Chair:

- Chair: prior experience working in the role of a Chair of a committee.
- Vice Chair: attributes and ability to assume Chair role and responsibilities, but not necessarily as much experience as the Chair.
- Chair and Vice Chair should come from different caucus groups (refer to Section 4).
- Should have already served at least 2 years on RAC, so they are familiar with the purpose, structure, and content of meetings.
- Willing and able to attend each RAC meeting during 3-year term.
- Ability to even-handedly articulate all interests.
- Consensus-builder.

The role of the Chair and Vice Chair will vary between RAC meetings; however, the Vice Chair's primary role is to take on Chair responsibilities in the absence of the Chair and/or at the discretion of the Chair. General responsibilities for the Chair are as follows:

1. Review RAC agenda prior to finalization and distribution to stakeholders (one week prior to RAC meetings).
2. Meet with the Management Committee prior to each RAC meeting to go over the RAC agenda and presentation(s) so that the RAC meeting runs smoothly and without interruption.
3. Manage the RAC agenda, select members to speak in turn, and keep the RAC on task and on time.
4. Convene each RAC meeting and initiate introductions.
5. Organize and call on public speakers during appropriate agenda items (if applicable) and determine public comment procedures (refer to Section 15).
6. Identify when the RAC has reached an impasse and needs to move forward with formal voting to resolve an issue (refer to Section 12).
7. Summarize key decisions and action items at the end of each RAC meeting.
8. Close meetings.
9. Ensure that notes are prepared summarizing discussion, agreements, and decisions.
10. Review and provide comments on RAC meeting notes.

The Chair and Vice Chair will serve for a period of two (2) years, concurrently. There is no limit to the number of terms served.

11. RAC Liaison to the MIRWMA Board of Directors

The RAC Chair will serve as liaison to the MIRWMA Board of Directors (also referred to as the MIRWMA Policy Committee), unless they delegate those duties to the Vice Chair. The RAC liaison will serve the following functions on behalf of the RAC.

1. Represent the interests, discussion, conclusions, and recommendations of the RAC.
2. Enlist other RAC members as necessary to represent RAC expertise and perspectives.
3. Report to the RAC on MIRWMA Board of Directors discussions, deliberations, and actions.

12. RAC Decision Process

The RAC, as an advisory body to MIRWMA, will strive to achieve consensus to the maximum extent possible. If consensus is not achievable, the Chair or Vice Chair shall call for a vote. All financial matters (e.g., identification of projects for inclusion in a grant application) require a vote.

Decision Making by Consensus

The RAC will strive to achieve consensus through discussion and debate at RAC meetings. For purposes of the RAC, consensus is defined as Level 1-4 on the list of consensus levels provided below:

1. I can say an **unqualified 'yes'** to the decision. I am satisfied that the decision is an expression of wisdom of the group.
2. I find the decision **perfectly acceptable**. It is the best of the real options we have available to us.
3. I can **live with** the decision. However, I'm not especially enthusiastic about it.
4. I do not fully agree with the decision and need to register my view about it. However, I do not choose to block the decision and will **stand aside**. I am willing to support the decision because I trust the wisdom of the group.
5. I do not agree with the decision and feel the need to **block** the decision being accepted as consensus.

6. I feel that we have no clear sense of unity in the group. We need to do more work before consensus can be achieved.

If needed, during discussion, the RAC Chair shall ask for a show of hands indicating each member's "consensus level" for the specific decision at hand. If all RAC members are a "consensus level" 1-4, the decision may proceed as a consensus decision. The Chair will provide an opportunity for those who are at "consensus level" 4 to express their concerns. If not all the RAC members are in consensus (one or more members are at "consensus level" 5 or 6), the RAC shall continue discussions to try to reach consensus. The RAC Chair is responsible for deciding when the RAC is at an impasse and will call for a vote at that point.

Voting Procedures

The RAC will make non-consensus decisions by vote:

- For approving all non-financial matters, if a vote is necessary due to the lack of consensus, a simple majority vote will be sufficient.
- For approving all financial matters (e.g., selection of projects for a grant application), a super majority (2/3 vote) of the RAC quorum will be required.
- In any case where the RAC is at a formal voting impasse and cannot make a decision, it will be up to MIRWMA's discretion to decide how to resolve the issue.

Once the RAC Chair has determined that the RAC is at an impasse and a vote is necessary, he/she will ask for a motion and a second. After the motion has been seconded, the RAC members will be given an opportunity for further discussion on the specific components of the motion. Following this discussion, the RAC Chair will call for a show of hands to pass or fail that motion.

13. Workgroup Member Selection

Periodically, the RAC will request the organization of an ad-hoc Workgroup to meet separately and work on an issue or topic that cannot readily be resolved in the broader RAC setting. Workgroups have historically been convened to provide direction to the RAC on matters such as project selection for grant funding. Note that the role of Workgroups is to provide a recommendation to the RAC; Workgroups are not charged with making decisions for the IRWM Program.

The RWMG may include a non-voting, non-RAC member to any Workgroup, if deemed appropriate for transparency and to provide expert knowledge.

Ad-Hoc Workgroups

The following process shall be followed when convening ad-hoc Workgroups:

1. The Management Committee and the RAC will jointly determine that a Workgroup is necessary, the number of members, and the topics. The RAC will identify the RAC representation for each Workgroup. Workgroups can also include representatives who are not RAC members.
2. If the RAC determines that representation from each caucus is preferred for a Workgroup, each caucus will deliberate and inform the RAC of their chosen representative(s) to the Workgroup. Workgroup members do not have to be current RAC members, but can be other stakeholders representing the caucus. If the caucus cannot reach a consensus recommendation, it will inform the RAC of this situation.
3. The RAC will review the proposed Workgroup members and provide a recommendation to the Management Committee. If the RAC cannot reach a consensus recommendation, it will inform the Management Committee of this situation.
4. The Management Committee will review the recommendation. Applicants will be notified by the Management Committee of their appointment to the Workgroup.

Project Selection Workgroup

The following process shall be followed when convening a Project Selection Workgroup to review and select projects for inclusion within a funding application:

1. The Project Selection Workgroup will be comprised of 5 MIRWMA representatives (one from each agency) and one representative from each voting caucus, for a total of up to 15 members.
2. The RAC caucuses will deliberate and inform the RAC of their chosen primary representative and alternate to the Workgroup. Project Selection Workgroup members must be current RAC members. If the caucus cannot reach a consensus recommendation, it will inform the RAC of this situation.
3. The RAC will review the proposed Workgroup members and provide a recommendation to the MIRWMA Board of Directors. If the RAC cannot reach a consensus recommendation, it will inform the MIRWMA Board of Directors of this situation.
4. The MIRWMA Board of Directors will review the recommendation. Applicants will be notified by the Management Committee of their appointment to the Workgroup.

14. Workgroup Decision Process

Workgroups, as advisory bodies to the RAC, will strive to achieve consensus to the maximum extent possible. If consensus is not achievable, the Chair or Vice Chair shall call for a vote. All financial matters require a vote. **Attachment D** provides a summary of the Workgroup Decision Process.

Project Selection Workgroup Decision Process

Because they address financial matters (e.g., selection of projects for a grant application), the Project Selection Workgroups have a unique decision process. In addition to the ground rules, consensus definitions, and Chair selection process provided in Attachment D, the following policies shall be followed when convening Project Selection Workgroups:

- Workgroup discussion will be limited to primary members, not alternates. Agenda will include multiple scheduled breaks so primary and alternate members have a chance to caucus and discuss progress of meeting. Alternates must still attend to hear the discussion should they need to serve in primary capacity at a later meeting.
- Any Workgroup member with a personal financial interest in a submitted project (see conflict of interest definition in Section 6) must step down from the Workgroup. If this arises, the Workgroup member will be replaced by his/her alternate and a new alternate will be selected.
- Only primary members should vote, even in informal polling (otherwise representation is skewed). If a primary member abstains for any reason, their alternate may vote.
- Workgroup members may vote on packages that contain projects submitted by their agency or organization; however, they will recuse themselves from discussing and/or advocating for projects.

15. Public Comments at RAC Meetings

RAC meetings are open to the public, and public comments are welcomed and encouraged. To ensure that members of the public have an adequate chance to provide comments, the RAC Chair will invite public comments to members of the public in attendance on any agenda item in which the RAC is making a decision or formulating a recommendation. An open public comment period may be offered at the end of RAC meetings to allow members of the public to speak to non-agenda topics.

If there is substantial public interest or comment on a topic, the RAC Chair or Vice Chair may implement the following procedures to ensure that such comments are received in a timely manner:

- Members of the public will be asked to fill out a speaker card to indicate their name, affiliation, contact, and the specific agenda item they wish to speak to (if applicable).

- Speaker cards will be limited to one per person per agenda item. Participants may submit multiple speaker cards to address multiple agenda items.
- The RAC Chair or Vice Chair will invite those who submitted speaker cards to address the agenda item prior to calling for a consensus decision and/or vote on that item.
- Speaker cards will generally allow three minutes of public speaking time per speaker. However, in the event that there are a large number of public speaker comments, it will be up to the discretion of the RAC Chair or Vice Chair to reduce the time for each public speaker to ensure that all agenda items are addressed and that the RAC meeting closes on time.

Attachment A
RAC Membership Composition

The following are the ten voting categories (caucuses) and invited non-voting participants in the Merced Regional Advisory Committee (RAC). The caucuses represent the diverse interests of the Merced Region. Within each caucus, the subcategories (numbered lists) identify the types of interests that may be represented; however, the RAC and MIRWMA will maintain the flexibility to identify and appoint RAC members who best represent regional interests of the category, without a rigid adherence to the subcategories listed.

Voting Categories / Caucuses (Maximum Number of Representative per Caucus shown in parentheses)

Agriculture (4)
Representatives of farming and ranching operations, including large and small farms/ranches, irrigated and non-irrigated agriculture, and tree and row crops.
- Commodity farming
- Dairy ranching
- Non-irrigated ranching or farming
- Other (at-large) agriculture

Business (4)
Representatives of non-farm business activities in the region, including business associations.
- Food processing and industrial operations
- Commercial businesses
- Institutions (e.g. college/university administration)
- Building and real estate

Natural Resources and Watersheds (4)
Agencies and entities focused on preserving, enhancing, and managing natural resources and watersheds, including fisheries and wetlands.
- Fisheries
- Wetlands
- Habitat/land preservation
- Conservation

Disadvantaged Communities/Environmental Justice (2)
Representatives of disadvantaged neighborhoods and small communities with water management challenges.
- Urban DAC
- Rural DAC

Land Use (3)
Representatives with land planning expertise, including land planners (assessor), planning commissioners, and land use advocates.
- Incorporated
- Unincorporated
- Advocacy

Water/Wastewater Management (3)
Public agencies and private entities that are not members of the RWMG and have statutory authority to supply municipal or irrigation water, manage wastewater, or provide flood control in the region.

- Agricultural water supply
- Wastewater
- Flood management

Academic/Educational (2)
Representatives of K-12 and college/university educators and academics.
- K-12
- College/university

Civic (2)
Representatives of community organizations, including community service, good government, and taxpayer interests.

Recreation (2)
Representatives of fishing, boating, birding, and park interests.

Other (At Large) Members (4)
Other agencies and entities with interest in and/or impact on water resource management.

Total voting members: 30

Non-Voting Members

MIRWMA members and state, federal, and regional agencies who are interested parties

Merced Integrated Regional Water Management Authority (5)

1. County of Merced
2. Merced Irrigation District
3. City of Merced
4. City of Atwater
5. City of Livingston

Others

1. Department of Water Resources
2. Regional Water Quality Control Board
3. U.S. Fish and Wildlife Service
4. California Department of Fish and Wildlife
5. U.S. Army Corps of Engineers
6. Adjacent IRWM Regions

Attachment B – RAC Membership Application

Attachment B
Merced Integrated Regional Water Management (IRWM) Program Regional Advisory Committee (RAC) Membership Application

The RAC serves as an advisory body providing recommendations to MIRWMA on key issues related to IRWM planning, stormwater resources planning, and related funding applications.

Thank you for your interest in serving on the RAC. Having an involved and dedicated RAC is vital to successful ongoing IRWM planning efforts in the Merced Region. RAC meetings are held **quarterly**, or as needed.

The following are desired attributes for RAC members and their alternates:

1. Have knowledge and experience in water resources management.
2. Represent an agency, organization, tribe, academia, or interests that are under-represented in the region.
3. Have the ability and desire to objectively articulate the perspective of his/her RAC seat and caucus at a level beyond that of his/her individual organization.
4. Provide recommendations with the best interests of the entire Merced IRWM region in mind.

In relation to criterion 3 listed above, RAC members are grouped into ten caucuses, each of which has a specified number of seats as outlined in **Attachment A**.

The following are general duties for which RAC members and their alternates are responsible:

1. Attend meetings consistently – participation in 75% of the meetings annually is the minimum expectation.
2. Come prepared – review materials ahead of time and provide comments as appropriate.
3. Be responsive to requests between meetings.
4. Act as a point of contact within his/her individual organization for collection and dissemination of information related to the IRWM Program.
5. Disseminate information about the IRWM Program to his/her contacts, as appropriate.
6. Designate an alternate to attend and participate in RAC meetings in his/her absence.
7. Recuse him/herself from discussion and voting if he/she has a personal interest or stake in the outcome.

The RAC has a formal charter (see www.mercedirwmp.org) which contains the rules and guiding principles established for the RAC. Please review the RAC Charter before submitting your application to ensure that you are able and willing to serve on the RAC and follow the guidelines and rules established in the RAC Charter.

If you have any questions about the Merced IRWM Program or the RAC, please contact the Merced IRWM Program Manager Hicham ElTal (heltal@mercedid.org, (209) 722-5761).

Attachment B – RAC Membership Application

Merced Integrated Regional Water Management (IRWM) Program
Regional Advisory Committee (RAC) Membership Application

Please return this form to Hicham ElTal (heltal@mercedid.org) by <date>. Selected RAC members will be notified by <date>; their first RAC meeting will be <date>.

Name: ______________________________

Organization: ______________________________

Email: ____________________ Phone Number: ____________________

Please indicate which specific seat within the RAC you are applying for (refer to Attachment A for detailed descriptions).

1st Choice: ______________________________
Caucus Interest

2nd Choice: ______________________________
Caucus Interest

Please indicate if you meet the eligibility criteria:

☐ Represent an agency, organization, tribe, academia, or interests that are under-represented in the region.

Describe your knowledge and experience related to water management, including participation in the IRWM Program, stormwater resources planning, or other water resource policy, planning, outreach, or implementation efforts:

Describe how your experience and knowledge allows you to:

1. **Have the ability and desire to objectively articulate the perspective of your interest and caucus at a level beyond that within your individual organization.**
2. **Provide recommendations with the best interests of the entire Merced IRWM region in mind.**

Describe how your position within your organization allows you to:

1. **Act as a point of contact within your individual organization for collection and dissemination of information related to the IRWM Program.**
2. **Disseminate information about the IRWM Program to your contacts, as appropriate.**

Attachment C
Merced Integrated Regional Water Management (IRWM) Program / Storm Water Resources Plan (SWRP)
Regional Advisory Committee (RAC) Attendance Policy

Thank you for your commitment to being an active member of the Merced RAC. Having an involved and dedicated RAC is vital to successful ongoing IRWM and SWRP planning efforts in the Merced region. The RAC meetings are held quarterly or as-needed.

To that end, the RAC has established an attendance policy that expects participation in at least 75% of the RAC meetings annually. The RAC recognizes that you may occasionally be unavailable due to schedule conflicts, sickness, or other emergencies. In such case, an alternate may attend in your place to ensure that the RAC benefits from the water resources perspective you represent. Please document your alternate below.

If neither you nor your alternate can attend, absences should be communicated to the Merced IRWM Program Manager Hicham ElTal (heltal@mercedid.org, (209) 722-5761). When your absence is foreseeable, please provide as much notice as possible. When you are absent from RAC meetings, your participation is truly missed.

Excessive absences may lead the RAC to request your resignation. If you fail to respond, the RAC will consider that you have voluntarily resigned your position. We appreciate your support, understanding, and acknowledgement of your time commitment to the RAC by your signature below.

I acknowledge and agree by my signature below to abide by this policy to the fullest extent practicable.

RAC Member

Print Name ____

Signature ______________________________ **Date**___________

RAC Alternate

Print Name ____

Attachment D
Decision Process for RAC Workgroups

Ground Rules

1. Treat everyone with respect and courtesy.
2. Provide everyone an opportunity to participate: all perspectives are valued.
3. Listen actively and openly.
4. Focus on new input; avoid redundancy.
5. Be concise and constructive.
6. Have fun.

Levels of Consensus

Consensus is achieved if all participants indicate that they are at Levels 1 through 4 (not Levels 5 or 6). The Levels of Consensus are:

1. I can say an **unqualified 'yes'** to the decision. I am satisfied that the decision is an expression of wisdom of the group.
2. I find the decision **perfectly acceptable**. It is the best of the real options we have available to us.
3. I can **live with** the decision. However, I'm not especially enthusiastic about it.
4. I do not fully agree with the decision and need to register my view about it. However, I do not choose to block the decision and will **stand aside**. I am willing to support the decision because I trust the wisdom of the group.
5. I do not agree with the decision and feel the need to **block** the decision being accepted as consensus.
6. I feel that we have no clear sense of unity in the group. We need to **do more work** before consensus can be achieved.

Considerations for Voting Rules

- Workgroups should strive to achieve consensus, which is defined as all Workgroup members voting at Consensus Levels 1 through 4.
- If Workgroup members are not in consensus (one or more members vote at Consensus Level 5 or 6), the Workgroup should continue discussion in an attempt to reach consensus.
- The Workgroup Chair will be responsible for deciding when the group is at an impasse, and is responsible for calling a vote at that point.
- For approving all non-financial matters, if a vote is necessary due to the lack of consensus, a simple majority vote will be sufficient.
- For approving all financial matters (e.g. selection of projects for a grant application), a super majority (2/3 vote) of the Workgroup will be required.
- When voting, Workgroup members only will vote. Alternates will only vote if the Workgroup member is absent or abstains.

Attachment D – RAC Workgroup Decision Process

Chair and Vice Chair Selection Process

1. Determine who is eligible: RAC members and alternates, preferably not MIRWMA members.
2. Provide an overview of preferred Chair/Vice Chair attributes:
   - Chair: prior experience in chair role
   - Vice Chair: attributes and ability to assume Chair role and responsibilities, but not as much experience as the Chair
   - Chair and Vice-chair should come from different categories (caucuses), e.g., agriculture, business, natural resources
   - Willing and able to serve
   - Ability to even-handedly articulate all interests
   - Consensus-builder
3. Outline responsibilities (see below).
4. Nominate and/or volunteer members to be the Chair and Vice Chair.
5. Reach consensus and/or vote.

Responsibilities of Workgroup Chair and Vice-Chair

General

- Oversight of Workgroup meetings and planning topics.
- Vice-Chair will be responsible in the absence of Chair and/or at the discretion of Chair.

Responsibilities Applicable to Workgroup Meetings

- Coordinate with Management Committee or Consultant on elements of the agenda prior to Workgroup meetings to understand overall goals, outcomes, and purpose.
- Convene meetings and initiate introductions.
- Ensure that someone is assigned to record notes of discussion, conclusions, agreements, and action items.
- Review and provide feedback on draft notes from meetings.
- Identify when the Workgroup has reached an impasse and needs to move forward with formal voting to resolve an issue.
- Summarize key decisions and action items at the end of each Workgroup meeting.
- Close meetings.

Responsibilities Applicable to RAC Meetings

- Report back to the RAC on Workgroup progress at RAC meetings.
- Coordinate with RWMG or Consultant on presentation materials for RAC meetings.
- Coordinate with Workgroup members from various caucuses to ensure that all perspectives are incorporated into presentations.

Responsibilities of Workgroup Members

1. Attend meetings consistently.
2. Come prepared (review materials ahead of time).
3. Be responsive to requests between meetings.
4. Follow the Ground Rules.
5. Represent RAC members within your caucus and keep them informed.

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Appendix B – Adopting Resolutions and Publication Records

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RESOLUTION MIRWMA NO. 2019-1

RESOLUTION OF BOARD OF DIRECTORS OF MERCED INTEGRATED REGIONAL WATER MANAGEMENT AUTHORITY ADOPTING THE 2018 MERCED INTEGRATED REGIONAL WATER MANAGEMENT PLAN UPDATE, AND ADOPTING NOTICE OF EXEMPTION RELATING THERETO

WHEREAS, the Merced Integrated Regional Water Management Authority (MIRWMA) Work Group, in close cooperation with its assigned Regional Advisory Committee (RAC) and other interested stakeholders, collectively developed a draft Merced Integrated Regional Water Management (IRWM) Plan update to optimize water supply reliability, protect and enhance of water quality, provide stewardship of natural resources and coordinate and integrate water resources management in the region; and

WHEREAS, the 2018 Merced IRWM Plan Update continues to defines the Merced Region as the Merced Groundwater Basin within Merced County, in addition the Dry Creek Watershed and the Merced River Watershed along the Merced River within Merced County; and

WHEREAS, the Merced IRWM Plan Update establishes plan's mission, vision, goals, objectives; and regional priorities; and

WHEREAS, achieving IRWM implementation grant funding will help achieve goals for the enhancement of water supply supported by MIRWMA along with other water managers within the Region; and

WHEREAS, having an IRWM Plan Update in place will position the Merced Region and MIRWMA to compete for funding opportunities under Proposition 1; and

WHEREAS, adoption of the Merced IRWM Plan by MIRWMA Board of Directors, is required for the Merced Region and for every entity that requests funds under Proposition 1; and

WHEREAS, The MIRWMA is adopting the 2018 Merced IRWM Plan Update after a number of public meeting, noticed workshops, and providing for public comments; and

WHEREAS, the IRWMP is CEQA exempt under applicable state laws and regulations including CEQA Guidelines §15262 and §15306.

NOW, THEREFORE, BE IT RESOLVED THAT:

1. The recitals set forth hereinabove are true and correct, and are incorporated herein.
2. The Board of Directors adopts the final draft of the 2018 Merced Integrated Regional Water Management Plan Update.

3. The Board finds the IRWMP to be CEQA exempt under applicable state laws and regulations including CEQA Guidelines §15262 and §1 5306, and authorizes the Work Group to execute and file a Notice of Exemption if such action is deemed appropriate.

PASSED AND ADOPTED by the Board of Merced Integrated Regional Water Management Authority this 13th day of March, 2019, by the following vote:

Ayes:	Members:	Cole, Espinoza, Marchini, Murphy
Noes:	Members:	None
Abstain:	Members:	None
Absent:	Members:	City of Livingston

Mike Murphy
Chair
City of Merced

Daron McDaniel
Vice Chair
County of Merced

Ad Order Information

Ad Number	Ad Type	Production Method	Production Notes
0003737122-01	MER-Legal Liner	AdBooker	

External Ad Number	Ad Attributes	Ad Released	Pick Up
		No	

Ad Size	Color
2 X 29 li	

Product	Placement	Times Run	Schedule Cost
MER-Merced Sun-Star	0300 - Legals Classified	2	$198.36

Run Schedule Invoice Text	Position
NOI UPDATE PUBLIC WORKSHOP JENNIFER MC	0301 - Legals & Public Notices

Run Dates
06/29/2018, 07/04/2018

Product	Placement	Times Run	Schedule Cost
MER-upsell.mercedsunstar.com	0300 - Legals Classified	2	$30.00

Run Schedule Invoice Text	Position
NOI UPDATE PUBLIC WORKSHOP JENNIFER MC	0301 - Legals & Public Notices

Run Dates
06/29/2018, 07/04/2018

NOTICE OF INTENT OF THE MERCED INTEGRATED REGIONAL WATER MANAGEMENT AUTHORITY TO PREPARE AN UPDATE TO THE MERCED INTEGRATED REGIONAL WATER MANAGEMENT PLAN

NOTICE IS HEREBY GIVEN that the Merced Integrated Regional Water Management Authority (MIRWMA) intends to prepare an update of the 2013 Merced Integrated Regional Water Management Plan (IRWMP). The Merced IRWMP is intended to encourage collaboration among participants to integrate regional strategies for management of water resources. The Merced IRWMP update will ensure continued compliance with the most recent State IRWM guidelines released in 2016.

All interested persons are invited to attend a public workshop scheduled for 3:00 pm on July 11, 2018 at City of Merced Council Chambers, 678 W 18th Street, Merced, for the purpose of notifying and informing the public about opportunities to participate in the update of the Merced IRWMP. This meeting is an opportunity for residents to learn about the State's IRWM Program, to see a presentation summarizing the IRWMP update process, and to learn how they can participate in the Plan Update and submit projects or comments for incorporation into the Plan. The Call for Projects, to solicit projects for inclusion in the Merced IRWMP update, will also be discussed as project solicitation will occur from approximately July 9, 2018 through August 23, 2018. Information related to the public workshop and the update of the Merced IRWMP will be posted at the Merced IRWMP website: mercedirwmp.org. If you have any questions, please call Hicham Eltal at Merced Irrigation District at (209) 354-2854 any weekday from 8:00 a.m. to 5:00 p.m.
MER- 3737122 6/29, 7/4

MERCED SUN-STAR · LOS BANOS ENTERPRISE
CHOWCHILLA NEWS · Chronicle · Atwater Signal · Vida

AFFIDAVIT OF PUBLICATION

Account #	Ad Number	Identification	PO	Cols	Lines
709654	0004094546	NOI MIRWMA IRWMP JENNIFER KIDSON	)I MIRWMA IRWMP JENNIFER KI	1	19

Attention:

WOODARD & CURRAN
100 WEST SAN FERNANDO ST., SUITE 320
SAN JOSE, CA 95113

PUBLIC NOTICE

The Merced Integrated Regional Water Management Authority (MIRWMA) is scheduled to adopt the 2018 Merced Integrated Regional Water Management Plan (IRWMP) Update at a public meeting to be held on Wednesday, March 13 at 2:00 p.m. at the Merced City Council Chambers, 678 W 18th Street, Merced. The IRWMP has been updated to meet the California Department of Water Resources' Guidelines for IRWM planning, which will enhance the Region's eligibility for state grants and promote regional water sustainability.
MER-4094546 2/27, 3/6

Declaration of Publication 2015.5 C.C.P.

STATE OF CALIFORNIA)
) ss.
County of Merced)

I am a citizen of the United States; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of the Merced Sun-Star, a newspaper of general circulation, printed and published in the city of Merced, County of Merced, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Merced, State of California, under the date of July 14, 1964 Case Number 33224 that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

February 27, 2019, March 06, 2019

I certify (or declare) under penalty of perjury that the foregoing is true and correct and that this declaration was executed at Merced, California on:

Date: 6th, day of March, 2019

Cynthia A. McNamara

Signature

Appendix C – Example Goals and Objectives

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Memorandum

Subject: **Example Goals and Objectives**

Prepared For: Merced Integrated Regional Water Management Plan – Regional Advisory Committee

Prepared by: RMC Water and Environment

Date: June 11, 2012

According to Integrated Regional Water Management (IRWM) Planning Guidelines published by the California Department of Water Resources in August 2010, IRWM Plans must clearly present plan objectives addressing major water-related issues and conflicts of the region, as well as the process used to develop the objectives. In addition, objectives must be measurable by some practical means so achievement of objectives can be monitored (this is achieved through identification of performance measures / metrics for tracking objectives). In developing IRWM Plan objectives, planning efforts must consider overarching goals that apply to their area, including the following.

- Basin Plan Objectives (related to water quality)
- 20x2020 water efficiency goals (related to demand management)
- Requirements of CWC §10540(c), which states that, at a minimum, all IRWM Plans shall address all of the following (note that these items do not necessarily have to be included in the objectives, just considered in the IRWM planning effort as Plan objectives are developed):
    - Protection and improvement of water supply reliability, including identification of feasible agricultural and urban water use efficiency strategies.
    - Identification and consideration of the drinking water quality of communities within the area of the Plan.
    - Protection and improvement of water quality within the area of the Plan consistent with relevant basin plan.
    - Identification of any significant threats to groundwater resources from overdrafting.
    - Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region.
    - Protection of groundwater resources from contamination.
    - Identification and consideration of water-related needs of disadvantaged communities in the area within the boundaries of the Plan.

The Merced IRWM program's Regional Advisory Committee (RAC) will play a critical role in developing objectives for the Merced IRWM Plan (MIRWMP). To assist in developing meaningful objectives for the Region, the Goals and Objectives identified in a variety of local plans have been compiled, and example objectives and performance measures have been developed to facilitate brainstorming.

Goals and Objectives of Local Plans

The following table summarizes Goals and / or Objectives contained in a variety of local documents covering various aspects of water management in the Merced Region. These goals and objectives are provided as reference to be used when developing objectives for the Merced Integrated Regional Water Management Plan.

Table 1: Goals and Objectives Identified in Merced Region Local Plans

	Document Name	Goals and / or Objectives
1	Region Acceptance Process	1. Establish the boundaries of its region for planning and funding purposes 2. Establish and further develop a group that maintains its vitality well beyond the current scope of this planning and funding program
2	Merced County - GPU Background Report	1. Build and preserve the San Joaquin Valley's best places 2. Establish a foundation from which subsequent planning policies and programs will be formulated
3	MAGPI - GWMP, 2008	1. Identify and implement a number of actions using modern technology and sound science to preserve and / or increase the quantity of groundwater resources to ensure adequate groundwater resources for future generations
4	Merced County GPU - Water Supply/Demand TM	1. Summarize conceptually a baseline condition as compared to projected groundwater and surface water demand
5	MAGPI - Data Assessment	1. Describe the regional hydrogeologic setting of the eastern Merced County 2. Identify and compile available water resources data needed to investigate potential conjunctive use opportunities in the Merced Groundwater Basin 3. Develop a data management plan for MAGPI members

	Document Name	Goals and / or Objectives
6	Merced County - GPU Alternatives Report	1. Establish a blueprint for growth, public services, and resource conservation to the year 2030 2. Efficient Land Use 3. Meet Projected Land Demand 4. Retain farmland in agricultural production 5. Maintain compatibility of agricultural production and resident comfort and safety in new growth 6. Provide access to new communities with proportionately less traffic on the streets and highways 7. Create new demands for transit services in existing unincorporated communities and new communities/towns 8. Design and construct roads that are sized to accommodate truck traffic 9. Minimize vehicular traffic in the area of existing rail crossings 10. Minimize conflicts between new growth and aviation users 11. Incorporate bikeways and trails in new towns/new communities 12. Logically plan water and wastewater expansions while supporting incremental growth 13. Plan water and wastewater systems for new communities with sustainable components and incorporate reclamation and reuse of highly-treated wastewater 14. Avoid development in the San Joaquin and Merced River corridors 15. Integrate improved storm drainage systems and approaches to prevent new flood hazards 16. Reduce exposure to local flood risks and/or the need for flood protection 17. Meet fire protection and law enforcement response goals 18. Minimize school overcrowding 19. Increase access to park and recreation facilities 20. Limit fiscal and infrastructure financing impacts 21. Avoid growth in the largest areas of the most ecologically sensitive areas of Merced County including the Grasslands Ecological Area, Merced River riparian corridor, and San Joaquin River corridor 22. Maximize ability to adapt to expected effect of climate change 23. Minimize greenhouse gas emissions and air quality impacts
7	Merced County - Flood Control Project FS	1. Reduce flows at the Black Rascal Creek diversion
8	Merced County SW Mgmt Program	1. Limit, to the Maximum Extent Practicable, the discharge of pollutants from the Merced Storm Water Group storm sewer system

	Document Name	Goals and / or Objectives
9	MID - Merced GW Basin GWMP	1. Protection and planned maintenance of groundwater quality 2. Protection and beneficial use of recharge areas 3. Monitoring of Basin parameters for the primary purpose of maintaining groundwater qualities and eliminating conditions of long-term overdraft
10	MID - GWMP	1. Contribute to meeting the regional water management goals established in the Merced Water Supply Plan
11	MID - Water Management Plan	1. Establish a dynamic list of Efficient Water Management Practices (EWMPs) 2. Establish criteria to evaluate the appropriateness of EWMPs 3. Implement appropriate EWMPs, while avoiding unnecessary or unreasonable planning, paperwork, or expense for water suppliers, thereby voluntarily achieving more efficient water management that currently exists or may be required by law 4. Create a constructive working relationship between agricultural water suppliers, environmental interest groups and other interested parties
12	MID- Water Supply Plan	1. Manage groundwater resources 2. Provide high quality, reliable supply for cities 3. Protect and enhance economic base 4. Protect Merced ID's Merced River water rights 5. Maintain consensus on water supply plan
13	MID-Cressey Basin Hydrogeologic Investigation	1. Collect geologic and hydrogeologic data from the subsurface to be used for an evaluation of the Cressey Basin site as a potential groundwater recharge location
14	MID - Public Water Supply Well Survey/Bear Creek Study	1. Conduct a survey of all public water supply wells within the subbasin to a common datum 2. Investigate the surface water-groundwater interactions along a 7-mile reach of Bear Creek and evaluate potential for recharge
15	MID - Basin Mgmt Obj.	1. Maintain the groundwater surface elevation during the peak summer irrigation season (July and August) in all aquifer systems at a level that will assure an adequate and affordable irrigation groundwater supply, and to assure a sustainable agricultural supply of good quality water now and into the future 2. Assure an adequate groundwater supply of adequate quality from the alluvial aquifer system for all domestic users in the sub-inventory unit and to assure the water supply can be utilized without impacting groundwater quality or inducing land subsidence

	Document Name	Goals and / or Objectives
16	City of Merced - 2010 UWMP	1. Maintain efficient use of urban water supplies 2. Continue to promote conservation programs and policies 3. Ensure that sufficient water supplies are available for future beneficial use 4. Provide a mechanism for response during water drought conditions
17	City of Merced - 2030 GP EIR	1. Disclose, analyze, and provide mitigation measures for all potentially significant environmental effects associated with adoption and implementation of the proposed Merced Vision 2030 General Plan
18	City of Atwater - 2005 UWMP	1. Respond to California Water Code Division 6 Part 2.6 requirements 2. Maximize groundwater resources through water-conserving measures, thus reducing the future need to import water
19	City of Livingston- Storm Drain Master Plan	1. Establish a recommended master plan for storm drainage facilities that will serve new development areas that are currently located within the City of Livingston's sphere of influence or are likely to be incorporated into the sphere of influence at some point in the foreseeable future 2. Provide recommendations for mitigating nuisance flooding in several problem areas of the existing City urbanized area and for eliminating some of the City's current detention/retention ponds that are considered undesirable due to issues related to aesthetics, environment, and/or maintenance
20	City of Livingston - Water Distribution System Master Plan	1. Establish water system design and planning criteria 2. Evaluate the existing water distribution system using computer hydraulic modeling 3. Perform a demand analysis and review supply capacity 4. Perform a system-wide storage analysis 5. Review existing system and propose improvements to enhance system reliability 6. Recommend improvements needed to service anticipated future growth 7. Develop a Capital Improvement Program for build-out conditions that will be used by the City in the determination of Development Impact Fees
21	City of Livingston - WWCS Master Plan	1. Establish wastewater collection system design and planning criteria 2. Review temporary flow monitoring program and data performed by another consultant 3. Evaluate the capacity of the existing wastewater collection system using computer hydraulic modeling 4. Review existing system and propose improvements to enhance system reliability 5. Recommend improvements needed to service anticipated future growth 6. Develop a Capital Improvement Program for buildout conditions that will be used by the City in the Determination of Development Impact Fees

	Document Name	Goals and / or Objectives
22	City of Livingston - Parks Master Plan	1. Identify and evaluate existing park and recreation areas 2. Assesses the need for additional park land, open space and recreation facilities 3. Establish criteria and standards for site selection, design and management 4. Recommend an approach to financing and implementation 5. Provide an overall approach to the park system
23	Plana CSD - Monthly Water Flow Data	N/A
24	Winton WSD - CCR, 2009	N/A
25	City of Livingston- Traffic Circulation Master Plan	1. Confirm the nature of circulation system improvements needed 2. Identify the probable cost of these improvements 3. Project the share of costs that will need to be borne by new development on a per residential dwelling or per commercial square footage basis

Appendix D – Project Solicitation and Prioritization

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Appendix D – Project Solicitation and Prioritization

Appendix D contains materials summarizing the projects submitted during the 2018 Merced IRWMP project solicitation period, as well as information on project prioritization and scoring.

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Project Name	Project Proponent	Project Type	Project Status	Project Description	Primary Benefit	Project Score
Atwater-McSwain Regulating/Recharge Basin	Merced Irrigation District	Construction	Planning	The project entails construction of a regulating/recharge basin. The basin will be excavated, and automated inlet and outlet gates will be constructed along with the necessary flow measurement and control. The overall footprint of the project site is estimated at 20 acres, and the basin will occupy approximately 15 acres. These numbers are approximate and will be solidified at a later date. The project will provide groundwater recharge in the area and also serve as a regulating reservoir to be used by MID operations personnel.	Water Supply	66
Ballico Community Water Service District 2nd Well Proposal funding	Ballico Community Water Service District	Construction	Conceptual	The Ballico Community Water Service District is in major need of funding to construct a second well and comply with state law. Currently there is only one well supplying water to the community of about 72 houses and the Ballico School and fire department. The current well is over 25 years old and in need of maintenance as well. Also according to enviromental health department the water supply lines need replacement soon due to being too old. The district currently only has enough funding to sustain itself.	Water Supply	68.25
Bear Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, & Merced Irrigation District)	Construction	Planning	Bear Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Bear Reservoir and downstream levee and channel improvements would increase the level of flood protection to the most populated areas of Merced County. Bear Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project would meet the requirements of the new flood control legislation.	Flood Management	55.75
Black Rascal Creek Flood Control Bypass/ Supplemental Groundwater Supply Improvements	Merced Irrigation District	Construction	Conceptual	MID's Le Grand Canal is a critical flood control facility capable of conveying water from the Lake Yosemite watershed. The canal originates at Lake Yosemite and terminates around the town of Le Grand, however during flood season it is intercepted midway by a coffer dam along with a breach, created by MID, at its crossing with Black Rascal Creek that diverts all drainage to the creek. The Le Grand Canal contributes up to 600 CFS of floodwater to Black Rascal creek. Without an existing flood control reservoir on Black Rascal Creek, the Lake Yosemite flood flows pose significant flooding risks to the City of Merced, adjacent unincorporated areas, and several communities downstream of Merced. Additionally, breaching of the canal prevents flows from continuing downstream within the canal, depriving agricultural areas of precious storm water supply. This project proposes a set of gates in the canal to replace the breach which is installed annually, allowing MID to redirect and control flood flows. This proposed control structure can also be utilized to send flood flows on alternate, longer routes creating an artificial offset to the timing of peak storm flows as well as permit storm flows to be directed to alternate creeks and artificial groundwater recharge areas. The potential for groundwater recharge cannot be understated as the Le Grand Canal supplies a large area that has historically faced declining groundwater levels and limited recharge.	Water Supply	73.25
Black Rascal Creek Flood Control Project	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Construction	Design	Construction of a regulating reservoir on Black Rascal Creek. Project location is immediately north of Yosemite Avenue and Arboleda Drive in northeast Merced. Project will provide protection against a 200-year storm event and will provide much needed flood control on the currently unprotected Black Rascal Creek Watershed. Project will be beneficial to the project area and also to all downstream areas. The reservoir will maintain a deadpool for wildlife purposes. During the flood season, the reservoir will act primarily as a flood control retarding basin. During the irrigation season, the reservoir will regulate irrigation flows thereby increasing Merced Irrigation District system water efficiency without impacting power generation scheduling at New Exchequer Dam with the Independant System Operator (ISO).	Flood Management	85
Burns Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Construction	Planning	Burns Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Burns Reservoir and downstream levee and channel improvements would increase the level of flood protection to the most populated areas of Merced County. Burns Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project would meet the requirements of the new flood control legislation.	Flood Management	55.75

Project Name	Project Proponent	Project Type	Project Status	Project Description	Primary Benefit	Project Score
Cash for Grass Pilot Program to Eliminate Wasteful Pollution Containing Water Run-off	City of Merced	Conservation/ Protection/ Restoration	Design	To educate about storm drains carrying pollution to creeks and begin a pilot program in the City of Merced to rebate water customers for converting their grass landscape into water efficient xeriscape with water efficient changes to their irrigation systems to eliminate pollution containing run-off. Xeriscape refers to landscaping in ways that reduce or eliminate the need for supplemental water from irrigation. Polluted run-off from urban landscapes goes into storm gutters and drains which flow to creeks; primarily Bear Creek and Black Rascal Creek. Excess irrigation of turf leads to increased water consumption, increased costs, it depletes our water supply and its run-off pollutes creeks. The program will serve to educate the public about storm water pollution and rebate them for converting grass and old irrigation systems into qualifying xeriscape with water efficient drip irrigation systems that will pollute less and save more water.	Environment	71.75
City of Merced Stom Drain Master Plan Update	City of Merced, MID	Plan Development	Planning	The City of Merced is seeking to prepare a revised Storm Drain Master Plan based upon the City's updated General Plan (Merced Vision 2030). The City Storm Drain last master plan was developed in 2002. Since then, the City's drainage system has been expanded and upgraded. The revised Storm Drain Master Plan will identify capacity deficiencies in several major segments of the City's storm drain system particularly with those areas of the system that rely intricately upon the Merced Irrigation District (MID) canal system for stormwater conveyance. The City will also look at ways to utilize storm runoff capture for groundwater recharge and reuse as irrigation water. The purpose of updating the storm drain master plan is to incorporate all of the projects completed since the last master plan was prepared into an updated storm drain computer model and master plan document, and to identify and prioritize a new set of storm drain projects to further improve the storm drain system in the City. The prioritized set of storm drain improvement projects for future funding.	Flood Management	86
Crocker Dam Modification	Merced Irrigation District	Construction	Conceptual	This project encompasses installation of automatic gates at MID's Crocker Dam, located just west of Merced at the bifurcation of Black Rascal Creek and Bear Creek. Crocker Dam is a fixed structure with removable plates that are installed every spring (sometimes multiple times depending on late rains) to raise the water level to allow irrigation diversions. The current configuration severely limits the operational flexibility and control over this facility, as the gate is primarily either "up" or "down," and opening or lowering the gate is a difficult task. It is proposed to replace these plates with automatic gates. The automatic gates would allow for MID to remotely operate the dam and adaptively manage the flows in Bear Creek/Black Rascal Creek. This would provide improved flood control downstream, water storage, and be a supply for groundwater recharge from stormwater (FloodMARS).	Water Supply	64.25
Design and Construction of Fish Screens at Merced River Diversions	California Department of Fish and Wildlife	Conservation/ Protection/ Restoration	Conceptual	Various Locations: Cuneo Ditch (RM 50.5), Canevaro Ditch (RM 48.9), Cowell (RM 45.2) and the Cowell#2 (RM 38.1) diversions are all in need of screening designs to minimize the instream maintenance currently required for proper function of the diversions, and to meet federal fish agency screen requirements to protect juvenile salmonids (salmon and steelhead) from being entrained into the diversions. This project proposes the design, permitting and installation at fish screens that will reduce the annual maintenance requirements as well as protect juvenile migratory fishes (salmon and steelhead)	Environment	48.25
Drought Tolerant Landscape Conversion	City of Merced	Construction	Planning	The City of Merced has over 400 acres of landscaped maintenance districts, parks, medians, and park strips requiring irrigation. All of these areas are on metered water and are funded by the General Fund. Converting center medians and strips of irrigated land is particularly important now that we are working to Make Water Conservation A Way Of Life in California. Legislation that came about during the severe drought years says that we may not irrigate ornamental turf unless it is a by-product of watering trees. Some areas of center medians were converted to drip irrigation and there are many other areas that could benefit from being replaced with drought tolerant landscape to promote less water use.	Community Stewardship	55.5
El Nido Recharge Basin	Merced Irrigation District	Construction	Conceptual	This project entails construction of additional recharge basins in El Nido. Work will include purchase, design of the recharge basin, design of the water conveyance facilities, design of the monitoring network and data collection program, and development of operations guidelines. Based on the design, permits and approvals will be obtained prior to construction. Construction activities include construction of the basin, construction of the recharge facilities, drilling of monitoring wells, installation of flow meters and check structures, and surveying. After construction the basin will be monitored for two years to gage the success of the basin and modify the operations guidelines if necessary.	Water Supply	69
Exchange Recycled Water for Surface Water in Parks	City of Merced	Demonstration Project	Conceptual	This project would take parks off of municipal groundwater and replace the irrigation with surface water. The City would provide recycled water to tne irrigation district in exchange for the surface water that would be used to water the parks. Initially it would be a demonstration project at a single project and could be expanded to other city parks as a water exchange program.	Environment	53.5

Project Name	Project Proponent	Project Type	Project Status	Project Description	Primary Benefit	Project Score
Fairfield Canal/ El Nido Superhighway	Merced Irrigation District	Construction	Conceptual	This project will consist of flood flow capacity improvements and canal automation which is essential for implementing Flood-MAR projects and conveying water to MID's existing El Nido Groundwater Recharge Basin. Additionally, canal automation will improve flood control operations especially when spring storms overlap with the irrigation season. During flood season, canal automation can also be used to turn the canals into mini flood control reservoirs, filling each pool level and storing water for release when safe. This will essentially, create miles of flood control storage. These types of operations are currently not possible as the conveyance system is over a century old and requires frequent manual adjustment for flow fluctuations. The Fairfield and El Nido Canal system can convey water to over 52,000 acres. This project would open that acreage up to potential groundwater recharge and flood control projects. During the irrigation season, canal automation will also help to reduce spills conserve water.	Water Supply	64.25
Lake Yosemite Booster Pump Station	Merced Irrigation District	Construction	Conceptual	Lake Yosemite receives inflows from MID's Main Canal. It has four primary outlets; the Tower Lateral, the Sells Lateral, the Fairfield Canal, and the Le Grand Canal. During winter operations, the lake level is so low that only the Tower Lateral can be used for outflow (unless a major storm event occurs) due to the other 3 canal headgates having a higher invert. This project entails installation of booster pump station to allow for full utilization of Lake Yosemite's storage capacity and diversion facilities. The Booster pump would permit MID to move Lake Yosemite water to other portions of the district and be a key tool in implementing Flood-MAR projects.	Water Supply	70.25
Le Grand-Athlone WD Surface Water Extension	Le Grand-Athlone Water District	Construction	Conceptual	Build conveyance infrastructure from MID's booster 3 or another facility southeast, eventually connecting to Chowchilla Water District facilities near the intersection of the Madera Canal and the Chowchilla River. The connection would allow flexibility in distributing flood and other types of water in the Exchequer and Friant systems. Surface water would be available to Merced SOI growers, Plainsburg Irrigation District, LeGrand-Athlone Water District, Sandy Mush Mutual Water Company and others that predominantly use groundwater only.	Water Supply	61.75
Livingston Canal Lining Project	Merced Irrigation District	Construction	Construction	The project will line a portion of the canal section of the Livingston Canal through the City of Atwater. The Livingston Canal is both a stormwater facility and irrigation facility.	Flood Management	52
Lower Merced River Stewardship Program Round 2	East Merced Resource Conservation Districts	Education	Planning	The purpose of this project is to improve watershed health through education and restoration (on Bear Creek). This project will focus on educating the public (e.g. farmers, students, educators, community representatives) on environmental issues pertaining to watershed health in Merced County along with removing Arundo around Bear Creek. We will host a variety of events such as; workshops, presentations, kayak clean-up/water quality monitoring days, tours and an after school natural resource program. By targeting a large focus group we hope to bring community awareness on environmental issues facing our local watersheds.	Community Stewardship	68
Main Canal at Head Siesmic Rehab	Merced Irrigation District	Construction	Conceptual	This project entails retrofitting the head gates of the main canal for seismic purposes. The Main Canal serves approximately 150,000 acres in the MID place of use.	Water Supply	49.75
Main Canal Offstream Regulating Reservoir Study	Merced Irrigation District	Feasibility Study	Conceptual	Perform a study on a 10,000 AF offstream regulating reservoir.	Water Supply	80.75
Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Construction	Planning	Mariposa Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Mariposa Reservoir and downstream levee and channel improvements would increase the level of flood protection to Planada and Le Grand. Both are DAC's in Merced County. Mariposa Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project would meet the requirements of the new flood control legislation.	Flood Management	55.75

Project Name	Project Proponent	Project Type	Project Status	Project Description	Primary Benefit	Project Score
McCoy Lateral Regulating Basin	Merced Irrigation District	Construction	Conceptual	This project includes constructing and integrating a regulating basin near the termination of Merced Irrigation District's (MID) McCoy Lateral, the furthest southwestern operational discharge location in the District. MID is required to provide Stevinson Water District with 24,600 AF annualy. The McCoy Lateral is currently one of the waterways in which water is delivered to Stevinson Water District. This basin will increase water supply management through increasing the efficiency, consistency and reliability of deliveries to MID Growers and Stevinson Water District. The project will also allow for the increase in the amount of flows traversing the westerly region of MID, thereby improving the water quality in the area in terms of temperature, decreased algae growth, PH balance and overall suitability for agricultural and landscape use.	Water Supply	60.5
Merced Groundwater Subbasin LIDAR	Merced Irrigation District	Plan Development	Conceptual	This project consists of LIDAR data of the Merced Groundwater Subbasin. This data will be used in conjunction with weather forecast data to predict local stormflows from rainfall events. The data will be tied to MID's proposed real time modeling of Bear, Black Rascal, and Burns Creeks.	Water Supply	69.75
Merced Irrigation Flood-MAR Canal Automation	Merced Irrigation District	Construction	Conceptual	Merced Irrigation District is proposing automation of certain facilities to enhance Flood-MAR capabilities and expand areas which can be recharged with stormwater events. The project consists of automating certain facilities including but not limited to the Washington Lateral, Northside Canal, Livingston Canal, Le Grand Canal, Caton Lateral, Escaladian Canal, Hammett Lateral, Atwater Canal, Cressey Lateral, and Arena Canal. Currently these canals have manual structures which require frequent human adjustment and inputs to safely manage flows. By automatizing these facilities, the district will be able to safely accommodate volatile and unpredictable storm flows while keeping canal levels high enough for Flood-MAR purposes. Additionally, this project will better manage surface water diversions and increase distribution efficiency by reducing spills.	Water Supply	39.25
Merced IRWM Region Climate Change Modeling	Merced Integrated Regional Water Management Authority (MIRWMA)	Feasibility Study	Conceptual	This project will link the existing Merced River PRMS model, developed by the USGS, with the WEAP system model to explore the potential range of climate change impacts the Region may experience and the effectiveness of various portfolios designed to help the region adapt to those anticipated changes. By linking the models, the Region can examine alternative water development and management options under a variety of climate change conditions to facilitate and efficiently evaluate multiple future scenarios. Several potential future scenarios will be assembled to simulate a range of future climate changes. These scenarios will be simulated with different portfolios of water projects in place to evaluate the effectiveness of each portfolio in adapting to the climate changes. The results will inform the Region as to which projects will perform best in terms of adaptive management and will identify areas where additional or different projects should be recommended to meet future needs.	Water Supply	53
Merced IRWM Regional GHG Emissions Inventory	Merced Integrated Regional Water Management Authority (MIRWMA)	Other	Conceptual	This Project has been devised to prepare a region-wide GHG emissions inventory for the Merced Region to establish baseline GHG emissions and to project future emissions under a Business as Usual scenario. This Project follows The Greenhouse Gas Protocol for the U.S. Public Sector, developed by World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), and the USEPA Climate Leaders Guide to Greenhouse Gas Management for Small Business & Low Emitters. The Greenhouse Gas Protocol is the global standard for calculating GHG emissions, and the USEPA guidance incorporates the WRI/WBCSD protocol in the context of U.S. GHG emissions. The results of the GHG inventory can be used to inform the region as to the regional impacts of their current practices on GHG emissions, as a measure against which to evaluate the effectiveness of future projects, and to aid in identifying projects to improve regional energy efficiency and reduce GHG emissions.	Environment	44.5
Merced Region Climate Change Outreach and Education	Merced Integrated Regional Water Management Authority (MIRWMA)	Education	Design	The project will be implemented by water/wastewater entities in the Region to educate & inform the public about climate change, potential impacts in the region, its effect on water resources, & actions they can take to help adapt to and mitigate for climate changes. The project consists of a school education program to incorporate into existing science curriculums & a public information program. The first project component will consist of classroom presentations, large group assemblies at schools, & creation/distribution of climate change-themed kits. The second project component will include providing information on water customers bills and effects on water supplies; flyers/brochures that can be placed at public locations; online materials that can be uploaded to the websites of entities in the Region; booths at local fairs/events; and presentations at events. Both components will closely tie to water & energy conservation.	Community Stewardship	63

Project Name	Project Proponent	Project Type	Project Status	Project Description	Primary Benefit	Project Score
Merced Region Water Use Efficiency Program	Merced Integrated Regional Water Management Authority (MIRWMA)	Conservation/ Protection/ Restoration	Design	The Merced Region Water Use Efficiency Program will be implemented by multiple water purveyors in the Region to increase the level of water conservation & ensure long-term water use efficiency by the regions urban and ag users. The plan promotes water management strategies that support the states goal of a 20% reduction in urban per-capita water use by 2020, and will do so in a way that is beneficial to DACs in the region. The Program consists of four components: (1)interior water efficiency fixture retrofits, primarily targeted at DACs; (2)exterior single family water use surveys & upgrades; (3)exterior water use surveys & upgrades for large landscapes, including CII & residential agriculture landscapes; & (4)the preparation of water use budgets for accounts with dedicated landscape meters. The retrofits for households located in DACs are subsidized because DACs are often unable to afford the upfront capital to participate in rebate-based conservation programs.	Water Supply	69
Merquin County Water District Recharge Basin	Merquin County Water District	Construction	Planning	The Merquin County Water District (MCWD) recharge basin would be constructed in the northeastern portion of the district to enhance the groundwater levels in the area. The MCWD relies on its existing irrigation wells during short water years and during the off season when surface flows are not available to met demand from the customers of the District. The basin is proposed for an area that is at the intersection of 1st Street and Van Cliff Road. There are open parcels at this location and the parcels can receive water from the Pump Ditch that is connected to the Eastside Canal. The parcels in this location are presently receiving irrigation water and have soil types of Delhi loamy sand (DdA) and Hilmar loamy sand (HhA), both soils have good infiltration rates. Prior to construction of the basin in this area the District will get permission for access to a parcel and conduct preliminary infiltration tests to determine if the parcel is suitable for a long term water application with a benefit of recharge to the area. Successful testing of a parcel will then move to be purchased by the District and then the construction of the recharge basin. The parcels in the area are mostly 20 acre parcels, basin size approximately 18 acres in surface area. The basin would be filled when surface water is available in wet years or during storm flows in the winter from the drainage flow in the Eastside Canal. Monitoring wells would be installed to monitor the groundwater levels.	Water Supply	65
MID to Lone Tree Mutual Water Company	Lone Tree Mutual Water Company	Construction	Planning	Build an earthen canal from MID's Benedict Lateral south to LTMWC's facilities. The project would consist of a conveyance facility starting near the intersection of Gurr Road and Sandy Mush Road head south approximately 2-miles and connecting to LTMWC facilities. The area of Red Top, where LTMWC is located, has significant land subsidence. This project would alleviate the need to run deep wells beneath the Corcoran Clay layer in some years.	Water Supply	55.5
Owens Reservoir Enlargement and downstream leveel and channel improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Construction	Planning	Owens Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Owens Reservoir and downstream levee and channel improvements would increase the level of flood protection to Planada and Le Grand, both DAC's. Owens Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project would meet the requirements of the new flood control legislation.	Flood Management	55.75
Planada Northwest 2019 Water System Improvement Project	Planada Community Services District	Construction	Design	The proposed project focuses on upgrades to the Planada Community Service District's (District) water distribution system to ensure consistent water delivery to residents of the community. Improvements include: replacement of undersized water lines in the northwestern part of town, with current thin-wall plastic 2", 3" and 4" diameter water lines upsized to 8" diameter Class 900 PVC pipe; upgrading old-style water meters to radio-read meters that have better leak-detection capabilities and can better track water usage and water wasting in the community; replacement of water main valves that are beyond their useful life and no longer operate or do not open and close all the way.	Water Supply	69.5
Real Time Simulation Flood Control Modeling - Bear Creek	Merced Irrigation District	Plan Development	Conceptual	This project consists of modeling Bear, Black Rascal, and Burns Creeks. These three creeks (or the confluence of them) run through the City of Merced and have historically caused flooding to the area. The real time simulation model (RTS) would utilize HEC-RAS and HEC-HMS modeling software. The ability to run real time simulations will improve the ability to forecast flood flows and flood events. This forecasting will be critical in utilizing flood flows for FLOOD-MAR projects in the area. Additionally, it will enable MID to be better prepared for flood flows which happen during the irrigation season. Excess surface water is often conservatively spilled in anticipation of a rain event that occurs during the irrigation season due to lack of forecasting information.	Flood Management	74.75

Project Name	Project Proponent	Project Type	Project Status	Project Description	Primary Benefit	Project Score
Rice Field Pilot Study Monitoring Wells	Merced Irrigation District	Construction	Planning	This Project entails construction of at least 3 groundwater monitoring wells to evaluate the efficacy of MID's rice field recharge pilot project.	Water Supply	64.5
Snelling Channel and Floodplain Restoration	Merced Irrigation District	Conservation/ Protection/ Restoration	Planning	Develop plans to remove dredger tailings down to the natural floodplain surface at a 600+ acre site near Snelling. Includes design, permitting, implementation to restore in-river spawning and rearing habitats for anadromous salmonids along the Merced River. Approximately 2 miles of river channel would be targeted for restoration activities, which would focus on the incised channels and armored spawning beds. Restoration objectives would be to construct pool and riffle sequences to promote improved spawning conditions and sediment transport conditions. Adjacent tailings would be excavated to appropriate floodplain depths to inundate under current flow regimes. Sort excavated material; spawning-sized gravels would be added to armored spawning beds, and fine materials added to the developed floodplain for riparian recruitment. Work with local diverters to construct channel features to reduce annual channel maintenance and upgrade diversion facilties to benefit fish and habitat.	Environment	43
Study for Potential Water System Intertie Facilities from Merced I.D. to LeGrand-Athlone W.D. and Chowchilla W.D.	Chowchilla Water District	Feasibility Study	Conceptual	Merced Irrigation District (MID), LeGrand-Athelone Water District (LGAWD) and Chowchilla Water District (CWD) desire to investigate the feasibility of improving and constructing water conveyance facilities to allow the transferring of irrigation water from MID to LGAWD and CWD. This analysis would review hydrologic data to assess how much water is available from MID for transfer to LGAWD and CWD, when it is available, and how this water availability matches with the demands from LGAWD and the Merced County portion of CWDs service area. A preliminary topographic survey would be performed to gather data on portions of two of the proposed alignments south of the Planada Canal and one south of the Fancher Lateral. A hydraulic analysis of the conveyance system utilizing HEC-RAS computer software would be utilized to bring alternative amounts of water to the districts. A cost analysis for the various options would be prepared.	Water Supply	86.75
University of California Merced Surface Water Augmentation	Merced Irrigation District and the University of California Merced	Construction	Planning	A sustainable water system balances economic, social and environmental needs to establish a balanced framework for sharing water. The University of California Merced is in the process of developing sustainable water strategies that include the optimization of water resources. Currently, the only source of UCM Campus water is the city well (aquifer), which provides 100% of water used by the campus. Irrigation accounts for 50% percent of the total potable water used by UCM. The Merced Irrigation District and the University of California Merced are partnering to support the interconnection of the University's irrigation water supply to the Fairfield Canal. Lake Yosemite which the Fairfield Canal originates from will charge the University's Little Lake through a delivery gate located adjacent to Scholars Lane Bridge. This non-potable water source will be used in lieu of ground water for irrigation, leaving groundwater in the basin for potable uses while optimizing the use of surface water.	Water Supply	59.25
Water Education and Public Information	City of Merced	Education	Ongoing Program	A project to fund City of Merced staffs' training courses for water and wastewater professionals. Also to assist with the public information campaigns for water use efficiency, storm drain pollution and Fats, Oils, and Grease. The project would send staff to various courses to increase their knowledge of the water and wastewater industry including and emphasizing water efficiency, storm drain pollution and FOG. Staff would demonstrate their knowledge via improved water management and attainment of higher state and water industry certifications. Water efficiency, storm drain pollution, and FOG campaigns are on-going and costly. Staff regularly attends public events and distributes campaign materials and efficiency devices, this project would help to off-set some of those costly devices to keep up public awareness and promote changes.	Community Stewardship	60.75
Water Efficiencies Rebate Program	City of Merced	Conservation/ Protection/ Restoration	Conceptual	This proposal's goals are to save water and energy by awarding rebates to customers for upgrading to water efficient appliances. Water efficient new appliances will be rebated as follows: $100 per dish washer, $100 per clothes washer, $50 for converting toilets to ultra-low flow models of 1.6 gpf or less and new pool covers will also be rebated at $50 or 50% of the purchase price, whichever is less. Water conservation is needed to meet state mandates for 20% reduction by 2020. Many older homes have large water consuming appliances and this benefit will help our community to upgrade. By upgrading old appliances to water conserving devices, the customer can reduce water consumption and save energy without changing habits. This project will aid water users in the disadvantaged community of the City of Merced.	Water Supply	63.25
Water Meter Conservation Project	City of Atwater	Construction	Design	Install water meters at connections that feed the biggest lots in the City of Atwater. Currently the City of Atwater has 1/3 of their connections on water meters. Most of these our homes built after 1992 and have smaller lot sizes. The homes with bigger lot sizes are currently not charged based on their water consumption, just on a flat rate. The City would like to install meters on these lots to assist with better billing and better water conservation. It would also help the City with their annual report for water loss.	Water Supply	49.25

Project Name	Project Proponent	Project Type	Project Status	Project Description	Primary Benefit	Project Score
Weather Based Irrigation Controllers	City of Merced	Conservation/ Protection/ Restoration	Ongoing Program	This project is for the purchase and installation of Toro Sentinel Controllers for parks irrigation systems in the City of Merced. The Toro Sentinel Controllers are weather based irrigation controllers. The City began to use the Toro Sentinel Controllers in 2011 and currently has 68 units in the parks and maintenance districts. This powerful, yet simple-to-use controller software is ideal for large sites such as cities as it allows a user to control up to 999 field satellites from a remote location with a desktop or laptop computer. The City has a need for approximately 100 more units. The controllers can remotely shut off water, change irrigation times, days, and set alarms for stations if malfunctions occur such as power outages or extreme flows. Having the Toro Sentinel Controllers reduces manual labor and travel time from controller to controller and most importantly aids in water efficiency as the controller automatically adjusts for changes in weather.	Community Stewardship	68.75
Well 20 TCP Treatment	City of Atwater	Construction	Conceptual	Redesign and install treatment for 1,2,3-TCP at Well 20. Currently Well 20 has been drilled but nothing else has been done since there was found to be high levels of 1,2,3-TCP during pump testing. Well 20 used to be the second highest producing well in the city until high levels of manganese and iron were found due to the well being drilled too deep. A new hole was drilled on the same lot but needs additional money to cover cost of installing water treatment. City suffers from poor water pressure during summer at peak usage hours due to well not being online.	Water Supply	53.75

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Merced IRWMP Update 2018
Project Scoring Guide for IRWMP Project List

Component	Criterion	Scoring Procedure	Raw Score Assigned	Final 2018 Weights	
				% of Score	Subtotal
1. Principles of IRWM Planning	Addresses IRWM Plan Objectives	Score based on # of objectives addressed with highest priority objectives counting as two objectives	6+ objectives = 100 pts 5 objectives = 80 pts 4 objectives = 60 pts 3 objectives = 40 pts 2 objectives = 20 pts	15	25
	Employs Multiple Resource Management Strategies	Score based on # of strategies employed	8+ strategies = 100 pts 6-7 strategies = 75 pts 4-5 strategies = 50 pts 2-3 strategies = 25 pts	10	
2. Project Status and Feasibility	Is Ready to be Implemented	Score based on degree of work needed prior to implementation	Ready to construct / implement (or is a paper study) = 100 pts Preliminary Design Completed = 75 pts Planning Completed = 50 pts Planning in Progress = 25 pts No Work Completed = 0 pts	7	30
	Is Technically Feasible	Score based on technical feasibility documentation	Feasibility documentation is available, or explanation of feasibility is provided = 100 pts No feasibility information is provided = 0 pts	8	
	Is Economically Feasible	Score based on estimated benefit:cost ratio	B:C Ratio = 4 = 100 pts B:C Ratio ≥ 3 and < 4 = 75 pts B:C Ratio ≥ 2 and < 3 = 50 pts B:C Ratio ≥ 1 and < 2 = 25 pts B:C Ratio < 1 = 0 pts	8	
	Has a Local Funding Match	Score based on status of local funding match	Local funding match secured = 100 pts Local funding match not secured and project is in an unincorporated area = 50 pts Local funding match not secured = 0 pts	7	
3. Other Regional Priorities	Benefits Disadvantaged Communities	Score based on providing targeted benefits to more significantly disadvantaged communities within the region, considering household income and percentage of households below the poverty level	Project directly benefits El Nido, Planada or Franklin/Beachwood = 100 pts Project directly benefits Le Grand or Winton = 75 pts Project directly benefits Atwater, Snelling, Livingston, Stevinson, or DAC areas of City of Merced = 50 pts Project directly benefits regional community, but benefits not targeted to a specific DAC = 25 pts Does not provide a benefit to a disadvantaged community = 0 pts	9	45
	Directly Addresses a Critical Water Supply or Water Quality Need of a Disadvantaged Community	Score is based on Yes/No response	Yes = 100 pts No = 0 pts	10	
	Addresses an existing environmental justice (EJ) issue or provides benefits to disadvantaged underrepresented communities (DUCs), including unincorporated areas.	Score is based on Yes/No response	Yes = 100 pts No = 0 pts	4	
	Provides benefits to Native American Tribal Communities	Score is based on Yes/No response	Yes = 100 pts No = 0 pts	0	
	Contributes to Climate Change Adaptation or Mitigation	Score is based on number of adaptation and mitigation questions addressed	Yes to 3+ questions = 100 pts Yes to 1-2 questions = 50 pts Yes to 0 questions = 0 pts	11	
	Supported by Multiple Local Project Sponsors	Score is based on # of local project sponsors working together to implement the project	4+local project sponsors = 100 pts 3 local project sponsors = 75 pts 2 local project sponsors = 50 pts 1 local project sponsor = 25 pts	11	
Total					**100**

Rubric used for projects submitted during Call for Projects from July 9, 2018 to August 31, 2018.

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Project Name	Project Proponent	Project Type	Project Status	Score	Tier[1]	Estimated Cost	Primary Benefit
Study for Potential Water System Intertie Facilities from Merced I.D. to LeGrand-Athlone W.D. and Chowchilla W.D.	Chowchilla Water District	Feasibility Study	Conceptual	86.75	1	$ 100,000	Water Supply
City of Merced Stom Drain Master Plan Update	City of Merced, MID	Plan Development	Planning	86	1	$ 300,000	Flood Management
Black Rascal Creek Flood Control Project	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Construction	Design	85	1	$ 35,761,703	Flood Management
Main Canal Offstream Regulating Reservoir Study	Merced Irrigation District	Feasibility Study	Conceptual	80.75	1	$ 240,000	Water Supply
Real Time Simulation Flood Control Modeling - Bear Creek	Merced Irrigation District	Plan Development	Conceptual	74.75	1	$ 100,000	Flood Management
Black Rascal Creek Flood Control Bypass/ Supplemental Groundwater Supply Improvements	Merced Irrigation District	Construction	Conceptual	73.25	1	$ 1,000,000	Water Supply
Cash for Grass Pilot Program to Eliminate Wasteful Pollution Containing Water Run-off	City of Merced	Conservation/ Protection/ Restoration	Design	71.75	1	$ 65,680	Environment
Lake Yosemite Booster Pump Station	Merced Irrigation District	Construction	Conceptual	70.25	1	$ 100,000	Water Supply
Merced Groundwater Subbasin LIDAR	Merced Irrigation District	Plan Development	Conceptual	69.75	1	$ 150,000	Water Supply
Planada Northwest 2019 Water System Improvement Project	Planada Community Services District	Construction	Design	69.5	1	$ 2,184,198	Water Supply
El Nido Recharge Basin	Merced Irrigation District	Construction	Conceptual	69	1	$ 500,000	Water Supply
Merced Region Water Use Efficiency Program	Merced Integrated Regional Water Management	Conservation/	Design	69	1	$ 500,000	Water Supply
Weather Based Irrigation Controllers	City of Merced	Conservation/ Protection/	Ongoing Program	68.75	1	$ 540,000	Community Stewardship
Ballico Community Water Service District 2nd Well Proposal funding	Ballico Community Water Service District	Construction	Conceptual	68.25	1	$ 250,000	Water Supply
Lower Merced River Stewardship Program Round 2	East Merced Resource Conservation Districts	Education	Planning	68	1	$ 199,000	Community Stewardship
Atwater-McSwain Regulating/Recharge Basin	Merced Irrigation District	Construction	Planning	66	1	$ 3,300,000	Water Supply
Merquin County Water District Recharge Basin	Merquin County Water District	Construction	Planning	65	1	$ 1,400,000	Water Supply
Rice Field Pilot Study Monitoring Wells	Merced Irrigation District	Construction	Planning	64.5	1	$ 250,000	Water Supply
Crocker Dam Modification	Merced Irrigation District	Construction	Conceptual	64.25	1	$ 1,240,000	Water Supply
Fairfield Canal/ El Nido Superhighway	Merced Irrigation District	Construction	Conceptual	64.25	1	$ 3,000,000	Water Supply
Water Efficiencies Rebate Program	City of Merced	Conservation/	Conceptual	63.25	1	$ 100,000	Water Supply
Merced Region Climate Change Outreach and Education	Merced Integrated Regional Water Management Authority (MIRWMA)	Education	Design	63	2	$ 100,000	Community Stewardship
Le Grand-Athlone WD Surface Water Extension	Le Grand-Athlone Water District	Construction	Conceptual	61.75	2	$ 20,000,000	Water Supply
Water Education and Public Information	City of Merced	Education	Ongoing Program	60.75	2	$ 175,000	Community
McCoy Lateral Regulating Basin	Merced Irrigation District	Construction	Conceptual	60.5	2	$ 3,282,600	Water Supply
University of California Merced Surface Water Augmentation	Merced Irrigation District and the University of California Merced	Construction	Planning	59.25	2	$ 800,000	Water Supply
Bear Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, & Merced Irrigation District)	Construction	Planning	55.75	2	$ 20,000,000	Flood Management
Burns Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Construction	Planning	55.75	2	$ 15,000,000	Flood Management
Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Construction	Planning	55.75	2	$ 15,000,000	Flood Management
Owens Reservoir Enlargement and downstream leveel and channel improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Construction	Planning	55.75	2	$ 15,000,000	Flood Management
Drought Tolerant Landscape Conversion	City of Merced	Construction	Planning	55.5	2	$ 500,000	Community Stewardship
MID to Lone Tree Mutual Water Company	Lone Tree Mutual Water Company	Construction	Planning	55.5	2	$ 10,000,000	Water Supply

Projects submitted during Call for Projects from July 9, 2018 to August 31, 2018.

Project Name	Project Proponent	Project Type	Project Status	Score	Tier[1]	Estimated Cost	Primary Benefit
Well 20 TCP Treatment	City of Atwater	Construction	Conceptual	53.75	2	$ 3,000,000	Water Supply
Exchange Recycled Water for Surface Water in Parks	City of Merced	Demonstration	Conceptual	53.5	2	$ 80,000	Environment
Merced IRWM Region Climate Change Modeling	Merced Integrated Regional Water Management	Feasibility Study	Conceptual	53	2	$ 250,000	Water Supply
Livingston Canal Lining Project	Merced Irrigation District	Construction	Construction	52	2	$ 3,100,000	Flood Management
Main Canal at Head Siesmic Rehab	Merced Irrigation District	Construction	Conceptual	49.75	2	$ 1,600,000	Water Supply
Water Meter Conservation Project	City of Atwater	Construction	Design	49.25	2	$ 800,000	Water Supply
Design and Construction of Fish Screens at Merced River Diversions	California Department of Fish and Wildlife	Conservation/ Protection/ Restoration	Conceptual	48.25	2	$ 184,000	Environment
Merced IRWM Regional GHG Emissions Inventory	Merced Integrated Regional Water Management	Other	Conceptual	44.5	2	$ 150,000	Environment
Snelling Channel and Floodplain Restoration	Merced Irrigation District	Conservation/ Protection/	Planning	43	2	$ 1,020,000	Environment
Merced Irrigation Flood-MAR Canal Automation	Merced Irrigation District	Construction	Conceptual	39.25	2	$ 6,500,000	Water Supply

1. Tier 1 includes projects that scored in the top 50th percentile, Tier 2 included projects that scored in the bottom 50th percentile.

Project Information			Scoring Criteria:	Individual Criterion Scores												
				Addresses IRWM Plan Objectives	Employs Multiple Resource Management Strategies	Is Ready to be Implemented	Is Technically Feasible	Is Economically Feasible	Has a Local Funding Match	Benefits DACs	Directly Addresses a Critical Water Supply or Water Quality Need of a DAC	Addresses an EJ Issue or Benefits Disadvantaged Underrepresented Communities (DUCs)	Provides benefits to Native American Tribal Communities	Contributes to Climate Change Adaptation or Mitigation	Supported by Multiple Local Project Sponsors	Total Weighted Score
Project Name	**Project Proponent**	**Primary Benefit**	**Criteria Weights:**	**15%**	**10%**	**7%**	**8%**	**8%**	**7%**	**9%**	**10%**	**4%**	**0%**	**11%**	**11%**	**-**
Atwater-McSwain Regulating/Recharge Basin	Merced Irrigation District	Water Supply		100	100	25	100	25	50	100	100	100	0	0	25	66
Ballico Community Water Service District 2nd Well Proposal funding	Ballico Community Water Service District	Water Supply		100	25	0	100	100	50	100	100	100	0	50	25	68.25
Bear Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, & Merced Irrigation District)	Flood Management		100	50	25	0	25	50	100	100	100	0	0	50	55.75
Black Rascal Creek Flood Control Bypass/ Supplemental Groundwater Supply Improvements	Merced Irrigation District	Water Supply		100	100	0	100	25	100	100	100	100	0	50	25	73.25
Black Rascal Creek Flood Control Project	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Flood Management		100	100	50	100	25	100	100	100	100	0	100	50	85
Burns Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Flood Management		100	50	25	0	25	50	100	100	100	0	0	50	55.75
Cash for Grass Pilot Program to Eliminate Wasteful Pollution Containing Water Run-off	City of Merced	Environment		100	75	50	100	100	100	50	100	0	0	50	25	71.75
City of Merced Stom Drain Master Plan Update	City of Merced, MID	Flood Management		100	100	100	100	100	100	50	100	0	0	100	50	86
Crocker Dam Modification	Merced Irrigation District	Water Supply		100	100	0	100	25	50	100	100	100	0	0	25	64.25
Design and Construction of Fish Screens at Merced River Diversions	California Department of Fish and Wildlife	Environment		100	25	0	100	100	50	50	0	100	0	0	25	48.25
Drought Tolerant Landscape Conversion	City of Merced	Community Stewardship		100	25	25	100	50	100	50	100	0	0	0	25	55.5
El Nido Recharge Basin	Merced Irrigation District	Water Supply		100	100	0	100	50	50	100	100	100	0	0	50	69
Exchange Recycled Water for Surface Water in Parks	City of Merced	Environment		100	25	0	100	100	0	50	100	0	0	0	50	53.5
Fairfield Canal/ El Nido Superhighway	Merced Irrigation District	Water Supply		100	100	0	100	25	50	100	100	100	0	0	25	64.25
Lake Yosemite Booster Pump Station	Merced Irrigation District	Water Supply		100	100	0	100	100	50	100	100	100	0	0	25	70.25
Le Grand-Athlone WD Surface Water Extension	Le Grand-Athlone Water District	Water Supply		100	75	0	100	25	50	100	100	100	0	0	25	61.75
Livingston Canal Lining Project	Merced Irrigation District	Flood Management		100	100	100	100	25	0	50	0	0	0	0	50	52
Lower Merced River Stewardship Program Round 2	East Merced Resource Conservation Districts	Community Stewardship		100	100	25	100	100	50	75	0	100	0	0	100	68
Main Canal at Head Siesmic Rehab	Merced Irrigation District	Water Supply		100	100	0	0	25	100	100	0	100	0	0	25	49.75
Main Canal Offstream Regulating Reservoir Study	Merced Irrigation District	Water Supply		100	100	100	100	100	100	100	100	100	0	0	25	80.75
Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Flood Management		100	50	25	0	25	50	100	100	100	0	0	50	55.75
McCoy Lateral Regulating Basin	Merced Irrigation District	Water Supply		100	100	0	100	25	100	100	0	100	0	0	50	60.5
Merced Groundwater Subbasin LIDAR	Merced Irrigation District	Water Supply		100	100	100	100	100	0	100	100	0	0	0	25	69.75
Merced Irrigation Flood-MAR Canal Automation	Merced Irrigation District	Water Supply		100	25	0	100	25	0	100	0	0	0	0	25	39.25
Merced IRWM Region Climate Change Modeling	Merced Integrated Regional Water Management Authority (MIRWMA)	Water Supply		100	25	100	100	100	50	25	0	100	0	0	25	53
Merced IRWM Regional GHG Emissions Inventory	Merced Integrated Regional Water Management Authority (MIRWMA)	Environment		60	75	100	100	100	0	25	0	0	0	0	25	44.5
Merced Region Climate Change Outreach and Education	Merced Integrated Regional Water Management Authority (MIRWMA)	Community Stewardship		100	50	75	100	100	0	100	100	0	0	0	25	63
Merced Region Water Use Efficiency Program	Merced Integrated Regional Water Management Authority (MIRWMA)	Water Supply		100	75	75	100	50	50	100	100	100	0	0	25	69
Merquin County Water District Recharge Basin	Merquin County Water District	Water Supply		100	25	25	100	50	100	50	100	100	0	50	25	65
MID to Lone Tree Mutual Water Company	Lone Tree Mutual Water Company	Water Supply		40	50	25	100	0	50	100	100	100	0	50	25	55.5
Owens Reservoir Enlargement and downstream leveel and channel improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Flood Management		100	50	25	0	25	50	100	100	100	0	0	50	55.75
Planada Northwest 2019 Water System Improvement Project	Planada Community Services District	Water Supply		100	100	75	100	25	50	100	100	100	0	0	25	69.5
Real Time Simulation Flood Control Modeling - Bear Creek	Merced Irrigation District	Flood Management		100	75	100	100	100	50	100	100	100	0	0	25	74.75
Rice Field Pilot Study Monitoring Wells	Merced Irrigation District	Water Supply		100	25	25	100	100	50	100	100	100	0	0	25	64.5

Projects submitted during Call for Projects from July 9, 2018 to August 31, 2018.

Project Information			Scoring Criteria:	Individual Criterion Scores: Addresses IRWM Plan Objectives	Employs Multiple Resource Management Strategies	Is Ready to be Implemented	Is Technically Feasible	Is Economically Feasible	Has a Local Funding Match	Benefits DACs	Directly Addresses a Critical Water Supply or Water Quality Need of a DAC	Addresses an EJ Issue or Benefits Disadvantaged Underrepresented Communities (DUCs)	Provides benefits to Native American Tribal Communities	Contributes to Climate Change Adaptation or Mitigation	Supported by Multiple Local Project Sponsors	Total Weighted Score
Project Name	**Project Proponent**	**Primary Benefit**	**Criteria Weights:**	**15%**	**10%**	**7%**	**8%**	**8%**	**7%**	**9%**	**10%**	**4%**	**0%**	**11%**	**11%**	**-**
Snelling Channel and Floodplain Restoration	Merced Irrigation District	Environment		100	75	25	0	50	50	50	0	100	0	0	25	43
Study for Potential Water System Intertie Facilities from Merced I.D. to LeGrand-Athlone W.D. and Chowchilla W.D.	Chowchilla Water District	Water Supply		100	50	100	100	100	100	100	100	100	0	50	75	86.75
University of California Merced Surface Water Augmentation	Merced Irrigation District and the University of California Merced	Water Supply		100	50	25	100	50	100	100	0	100	0	0	50	59.25
Water Education and Public Information	City of Merced	Community Stewardship		100	25	100	100	50	100	50	100	0	0	0	25	60.75
Water Efficiencies Rebate Program	City of Merced	Water Supply		100	25	0	100	100	100	50	100	0	0	50	25	63.25
Water Meter Conservation Project	City of Atwater	Water Supply		60	25	50	100	25	100	50	100	0	0	0	25	49.25
Weather Based Irrigation Controllers	City of Merced	Community Stewardship		100	50	100	100	50	100	50	100	0	0	50	25	68.75
Well 20 TCP Treatment	City of Atwater	Water Supply		80	75	0	100	25	100	50	100	0	0	0	25	53.75

Projects submitted during Call for Projects from July 9, 2018 to August 31, 2018.

			Information provided by project proponents in Opti					Conversions to 2018 dollars					Cost Score		Benefit Score		Overall B-C Score	
Project Name	Project Proponent	Project Status	Estimated Project Cost	Annual O&M	Base Year for Costs	Estimated Project Life	Has a project economic analysis and/or benefit cost ratio been developed for the project?	Capital Cost, original year $ (Total cost minus O&M, if provided)	Capital Cost, 2018 $[1]	Annual O&M Cost, original year $[2]	Annual O&M Cost, 2018 $[1]	Project Life for PV Calculations[3]	Present Value Cost[4]	Cost Score[5]	Number of Objectives Met	Benefit Score[6]	B:C Ratio[7]	Final Simulated B:C Ratio Score[8]
Atwater-McSwain Regulating/Recharge Basin	Merced Irrigation District	Planning	$ 3,300,000.00	-	2017	30	No	$ 3,300,000	$ 3,361,485	$ 330,000	$ 336,149	30	$ 7,988,513	4	13	4	1.0	25
Ballico Community Water Service District 2nd Well Proposal funding	Ballico Community Water Service District	Conceptual	$ 250,000.00	-	2013	-	No	$ 250,000	$ 286,280	$ 25,000	$ 28,628	20	$ 614,640	1	10	4	4.0	100
Bear Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, & Merced Irrigation District)	Planning	$ 20,000,000.00	-	2012	100 years	No	$ 20,000,000	$ 23,269,928	$ 2,000,000	$ 2,326,993	100	$ 61,938,838	4	13	4	1.0	25
Black Rascal Creek Flood Control Bypass/ Supplemental Groundwater Supply Improvements	Merced Irrigation District	Conceptual	$ 1,000,000.00	-	2018	-	No	$ 1,000,000	$ 1,000,000	$ 100,000	$ 100,000	20	$ 2,146,992	3	15	4	1.3	25
Black Rascal Creek Flood Control Project	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Design	$ 35,761,703.00	-	2017	60 years	Yes	$ 35,761,703	$ 36,428,009	$ 3,576,170	$ 3,642,801	60	$ 95,300,873	4	13	4	1.0	25
Burns Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Planning	$ 15,000,000.00	-	2012	100 years	No	$ 15,000,000	$ 17,452,446	$ 1,500,000	$ 1,745,245	100	$ 46,454,129	4	13	4	1.0	25
Cash for Grass Pilot Program to Eliminate Wasteful Pollution Containing Water Run-off	City of Merced	Design	$ 65,680.00	-	2012	-	No	$ 65,680	$ 76,418	$ 6,568	$ 7,642	20	$ 164,070	1	11	4	4.0	100
City of Merced Stom Drain Master Plan Update	City of Merced, MID	Planning	$ 300,000.00	-	2019	-	-	$ 300,000	$ 300,000	$ 30,000	$ 30,000	20	$ 644,098	1	11	4	4.0	100
Crocker Dam Modification	Merced Irrigation District	Conceptual	$ 1,240,000.00	-	2018	-	-	$ 1,240,000	$ 1,240,000	$ 124,000	$ 124,000	20	$ 2,662,270	3	13	4	1.3	25
Design and Construction of Fish Screens at Merced River Diversions	California Department of Fish and Wildlife	Conceptual	$ 184,000.00	-	2013	3 years (one per screen)	-	$ 184,000	$ 210,702	$ 18,400	$ 21,070	3	$ 267,023	1	9	4	4.0	100
Drought Tolerant Landscape Conversion	City of Merced	Planning	$ 500,000.00	-	2011	25	No	$ 500,000	$ 591,531	$ 50,000	$ 59,153	25	$ 1,347,707	2	6	4	2.0	50
El Nido Recharge Basin	Merced Irrigation District	Conceptual	$ 500,000.00	-	2012	-	No	$ 500,000	$ 581,748	$ 50,000	$ 58,175	20	$ 1,249,009	2	13	4	2.0	50
Exchange Recycled Water for Surface Water in Parks	City of Merced	Conceptual	$ 80,000.00	-	2012	-	No	$ 80,000	$ 93,080	$ 8,000	$ 9,308	20	$ 199,841	1	7	4	4.0	100
Fairfield Canal/ El Nido Superhighway	Merced Irrigation District	Conceptual	$ 3,000,000.00	-	2017	-	-	$ 3,000,000	$ 3,055,896	$ 300,000	$ 305,590	20	$ 6,560,984	4	13	4	1.0	25
Lake Yosemite Booster Pump Station	Merced Irrigation District	Conceptual	$ 100,000.00	-	2017	-	-	$ 100,000	$ 101,863	$ 10,000	$ 10,186	20	$ 218,699	1	13	4	4.0	100
Le Grand-Athlone WD Surface Water Extension	Le Grand-Athlone Water District	Conceptual	$ 20,000,000.00	-	2017	-	No	$ 20,000,000	$ 20,372,637	$ 2,000,000	$ 2,037,264	20	$ 43,739,891	4	7	4	1.0	25
Livingston Canal Lining Project	Merced Irrigation District	Construction	$ 3,100,000.00	-	2012	-	-	$ 3,100,000	$ 3,606,839	$ 310,000	$ 360,684	20	$ 7,743,855	4	11	4	1.0	25
Lower Merced River Stewardship Program Round 2	East Merced Resource Conservation Districts	Planning	$ 199,000.00	$2,000.00	2018	-	No	$ 197,000	$ 197,000	$2,000.00	$2,000.00	20	$ 219,940	1	11	4	4.0	100
Main Canal at Head Siesmic Rehab	Merced Irrigation District	Conceptual	$ 1,600,000.00	-	2012	-	-	$ 1,600,000	$ 1,861,594	$ 160,000	$ 186,159	20	$ 3,996,828	3	13	4	1.3	25
Main Canal Offstream Regulating Reservoir Study	Merced Irrigation District	Conceptual	$ 240,000.00	-	2012	-	-	$ 240,000	$ 279,239	$ 24,000	$ 27,924	20	$ 599,524	1	13	4	4.0	100
Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Planning	$ 15,000,000.00	-	2012	100 years	No	$ 15,000,000	$ 17,452,446	$ 1,500,000	$ 1,745,245	100	$ 46,454,129	4	13	4	1.0	25
McCoy Lateral Regulating Basin	Merced Irrigation District	Conceptual	$ 3,282,600.00	-	2014	50 years	-	$ 3,282,600	$ 3,624,229	$ 328,260	$ 362,423	50	$ 9,336,689	4	13	4	1.0	25
Merced Groundwater Subbasin LIDAR	Merced Irrigation District	Conceptual	$ 150,000.00	-	2018	-	-	$ 150,000	$ 150,000	$ 15,000	$ 15,000	20	$ 322,049	1	13	4	4.0	100
Merced Irrigation Flood-MAR Canal Automation	Merced Irrigation District	Conceptual	$ 6,500,000.00	-	2017	-	-	$ 6,500,000	$ 6,621,107	$ 650,000	$ 662,111	20	$ 14,215,465	4	13	4	1.0	25
Merced IRWM Region Climate Change Modeling	Merced Integrated Regional Water Management Authority (MIRWMA)	Conceptual	$ 250,000.00	-	2012	3 to 5 years	No	$ 250,000	$ 290,874	$ 25,000	$ 29,087	5	$ 413,401	1	8	4	4.0	100
Merced IRWM Regional GHG Emissions Inventory	Merced Integrated Regional Water Management Authority (MIRWMA)	Conceptual	$ 150,000.00	-	2012	3-5 years	No	$ 150,000	$ 174,524	$ 15,000	$ 17,452	5	$ 248,041	1	4	4	4.0	100

Projects submitted during Call for Projects from July 9, 2018 to August 31, 2018.

Merced IRWMP Update 2018
Simulated Benefit-Cost Score Summary

			Information provided by project proponents in Opti					Conversions to 2018 dollars					Cost Score		Benefit Score		Overall B-C Score	
Project Name	Project Proponent	Project Status	Estimated Project Cost	Annual O&M	Base Year for Costs	Estimated Project Life	Has a project economic analysis and/or benefit cost ratio been developed for the project?	Capital Cost, original year $ (Total cost minus O&M, if provided)	Capital Cost, 2018 $[1]	Annual O&M Cost, original year $[2]	Annual O&M Cost, 2018 $[1]	Project Life for PV Calculations[3]	Present Value Cost[4]	Cost Score[5]	Number of Objectives Met	Benefit Score[6]	B:C Ratio[7]	Final Simulated B:C Ratio Score[8]
Merced Region Climate Change Outreach and Education	Merced Integrated Regional Water Management Authority (MIRWMA)	Design	$ 100,000.00	-	2012	-	No	$ 100,000	$ 116,350	$ 10,000	$ 11,635	20	$ 249,802	1	13	4	4.0	100
Merced Region Water Use Efficiency Program	Merced Integrated Regional Water Management Authority (MIRWMA)	Design	$ 500,000.00	-	2012	-	No	$ 500,000	$ 581,748	$ 50,000	$ 58,175	20	$ 1,249,009	2	12	4	2.0	50
Merquin County Water District Recharge Basin	Merquin County Water District	Planning	$ 1,400,000.00	$6,000.00	2018	50	No	$ 1,394,000	$ 1,394,000	$6,000.00	$6,000.00	50	$ 1,488,571	2	6	4	2.0	50
MID to Lone Tree Mutual Water Company	Lone Tree Mutual Water Company	Planning	$ 10,000,000.00	-	2017	-	-	$ 10,000,000	$ 10,186,318	$ 1,000,000	$ 1,018,632	20	$ 21,869,945	4	3	3	0.8	0
Owens Reservoir Enlargement and downstream leveel and channel improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District)	Planning	$ 15,000,000.00	-	2012	-	No	$ 15,000,000	$ 17,452,446	$ 1,500,000	$ 1,745,245	20	$ 37,470,264	4	13	4	1.0	25
Planada Northwest 2019 Water System Improvement Project	Planada Community Services District	Design	$ 2,184,198.00	-	2018	-	No	$ 2,184,198	$ 2,184,198	$ 218,420	$ 218,420	20	$ 4,689,456	3	12	4	1.3	25
Real Time Simulation Flood Control Modeling - Bear Creek	Merced Irrigation District	Conceptual	$ 100,000.00	-	2018	-	-	$ 100,000	$ 100,000	$ 10,000	$ 10,000	20	$ 214,699	1	13	4	4.0	100
Rice Field Pilot Study Monitoring Wells	Merced Irrigation District	Planning	$ 250,000.00	-	2017	-	-	$ 250,000	$ 254,658	$ 25,000	$ 25,466	20	$ 546,749	1	13	4	4.0	100
Snelling Channel and Floodplain Restoration	Merced Irrigation District	Planning	$ 1,020,000.00	-	2012	5 years	No	$ 1,020,000	$ 1,186,766	$ 102,000	$ 118,677	5	$ 1,686,675	2	12	4	2.0	50
Study for Potential Water System Intertie Facilities from Merced I.D. to LeGrand-Athlone W.D. and Chowchilla W.D.	Chowchilla Water District	Conceptual	$ 100,000.00	-	2018	100 years	No	$ 100,000	$ 100,000	$ 10,000	$ 10,000	100	$ 266,175	1	14	4	4.0	100
University of California Merced Surface Water Augmentation	Merced Irrigation District and the University of California Merced	Planning	$ 800,000.00	-	2014	20 years	-	$ 800,000	$ 883,258	$ 80,000	$ 88,326	20	$ 1,896,349	2	13	4	2.0	50
Water Education and Public Information	City of Merced	Ongoing Progr	$ 175,000.00	$70,000.00	2012	-	No	$ 105,000	$ 122,167	$70,000.00	$ 81,445	20	$ 1,056,332	2	7	4	2.0	50
Water Efficiencies Rebate Program	City of Merced	Conceptual	$ 100,000.00	-	2018	24 months	No	$ 100,000	$ 100,000	$ 10,000	$ 10,000	2	$ 118,334	1	8	4	4.0	100
Water Meter Conservation Project	City of Atwater	Design	$ 800,000.00	-	2018	40	-	$ 800,000	$ 800,000	$ 80,000	$ 80,000	40	$ 2,003,704	3	4	4	1.3	25
Weather Based Irrigation Controllers	City of Merced	Ongoing Progr	$ 540,000.00	-	2011	25 years	No	$ 540,000	$ 638,854	$ 54,000	$ 63,885	25	$ 1,455,524	2	9	4	2.0	50
Well 20 TCP Treatment	City of Atwater	Conceptual	$ 3,000,000.00	-	3000000	25 YEARS	No	$ 3,000,000	$ 3,000,000	$ 300,000	$ 300,000	25	$ 6,835,007	4	5	4	1.0	25

Footnotes:
1. Costs that were not originally provided in 2018 dollars were converted to 2018 dollars using the ENR CCI for San Francisco (annual averages used).
2. If no O&M costs were provided, 10% of total project cost was assumed.
3. If no project life was provided, 20 years was assumed.
4. Discount factor of 6% assumed (based on previous IRWM guidance).
5. PV Cost ≥ $5M = 4 pts; $2M < PV Cost < $5M = 3 pts; $1 M < PV Cost ≤ $2M = 2 pts; Present Value Cost ≤ $1M = 1 pt
6. 4 or more objectives met = 4 pts; 3 objectives = 3 pts; 2 objectives = 2 pts; 1 objective = 1 pt
7. Benefits score divided by cost score; generally, B:C > 1 preferred as the benefits outweigh the costs.
8. Simulated B:C Ratio < 1 = 0 pts; simulated B:C Ratio ≥ 1 and < 2 = 25 pts; simulated B:C Ratio ≥ 2 and < 3 = 50 pts; simulated B:C Ratio ≥ 3 and < 4 = 75 pts; simulated B:C Ratio = 4 = 100 pts

Project Name:

Description:

Contact:

Partner(s):

Total Cost:

Last Update: Wednesday Nov 14, 2018

[Instructions](#) [Overview](#) [Proponents](#) [Objectives](#) [Strategies](#) [Benefits and Impacts](#) [Schedule and Budget](#) [IRWM Program Consistency](#) [SWRP Program Consistency](#) [SWRP Benefits](#)

Instructions [Top](#)

Project Submittal Form

The Merced Integrated Regional Water Management (IRWM) Region is soliciting projects for inclusion in the 2018 Merced IRWM Plan and Merced Storm Water Resources Plan (SWRP). Project proponents are encouraged to submit projects using the online project database available at http://www.mercedirwmp.org/projects.html.

Fields noted with an asterisk (*) are required.

Please submit projects by August 23, 2018. Questions should be directed to:

Jennifer Kidson
Woodard & Curran
(408) 831-4817
jkidson@woodardcurran.com

Overview [Top](#)

Project Info

*Select the Plan(s) for which you would like to enter your project (select IRWMP, SWRP, or both):

☐ **Merced Integrated Regional Water Management Plan:** Any project that would like to be considered for IRWM funding should select this program. Projects must meet at least one IRWM Plan Objective and be within the Merced IRWM Region in order to be considered for inclusion in the Plan. Other eligibility criteria for inclusion in a grant application is discussed in the Prop 1 Eligibility section. For more information about the IRWM grant program visit the California Department of Water Resources' [website](#).

☐ **Merced Stormwater Resources Plan:** All storm water and dry weather runoff capture projects (e.g., green infrastructure, rainwater and storm water capture, storm water treatment facilities, and demonstration or pilot projects that are consistent with the eligibility requirements of Prop 1, Chapter 7) should select this program, regardless of whether they are seeking IRWM and/or Storm Water grant funding. Inclusion in the Storm Water Resource Plan (SWRP) is required for storm water and dry weather runoff capture projects seeking Proposition 1 funding through any funding program. For more information about the Storm Water Grant Program visit the State Water Resources Control Boards [website](#).

Project Name: *

Project Description: * Provide a one paragraph description of your project

Project Type: *

Select

If other, please specify:

Project Website: Provide URL to project website, if available

Project Location

Project Coordinates: Enter decimal latitude and longitude below or

Latitude: * Longitude: *

Project Area:

File Name	Type

OR describe the project location:

Other Info

Project Need: Provide a one paragraph description of the need for your project.*

Technical Feasibility

Is this project technically feasible?* ☐ Yes ☐ No

List studies (e.g., Feasibility Study, Facilities Plan) that have been completed for this project. If feasibility studies have not been completed, describe how feasibility has been determined.*

Planning Documents: List local or regional planning documents that identify this project (e.g., Recycled Water Master Plan, Water Master Plan, drought contingency planning documents).

Supporting Documentation: Attach feasibility studies and planning documents relevant to this project

File Name	Description (relevancy, agency, weblink, date, etc.)	Type

Linkages with Other Projects: If applicable, describe how the project is related to other projects in the region or neighboring regions

Project Photos: Attach project photos, if available.

File Name	Description	Type

Data Management

What data will be collected from the project or monitoring of the project?

How will the data be disseminated/shared with the region?

How will the data be maintained?

Proponents Top

Project Proponent

Agency/Organization submitting project for consideration: *

Project Proponent (i.e., Agency/Organization implementing project) (if different than entity submitting project):

IRWMP Adoption

Is the project proponent planning to adopt the Merced IRWM Plan?* ☐ Yes ☐ No
If the project proponent is not currently planning to adopt the Merced IRWM Plan, will it adopt the plan if your project is selected for IRWM implementation funding? ☐ Yes ☐ No

Project Proponent Primary Contact

Name: *

Title:

Agency/Organization: *

Email Address: *

Phone Number: * Ext:

Address: *

Project Proponent Secondary Contact

Name:

Title:

Agency/Organization:

Email Address:

Phone Number: Ext:

Address:

Partners

Project Partners List partner agencies/organizations. Indicate which partners are located within the region:

Other Stakeholders List other stakeholders:

Stakeholder Outreach Describe any stakeholder outreach that has been conducted to date for this project:

Objectives Top

Objectives

***Regional Objectives** - Select all that apply. For each selected objective, provide a short description of how the project contributes to the IRWM Plan Objective. The Merced IRWM Region considers all the IRWMP Objectives to be high priority; within this, some have been deemed highest priority.

☐ **Objective A:** Correct groundwater overdraft conditions, promote direct and in-lieu recharge, and identify supplemental water.
☐ **Objective B:** Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management.
☐ **Objective C:** Meet demands for all uses, including agriculture, urban, and environmental resource needs.
☐ **Objective D:** Improve coordination of land use and water resources planning.
☐ **Objective E:** Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure.
☐ **Objective F:** Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible.
☐ **Objective G:** Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.
☐ **Objective H:** Protect, restore, and improve natural resources.
☐ **Objective I:** Address water-related needs of disadvantaged communities (DACs).
☐ **Objective J:** Protect and enhance water-associated recreation opportunities.

☐ **Objective K:** Establish and maintain effective communication among water resource stakeholders in the Region.
☐ **Objective L:** Enhance public understanding of water management issues and needs.

Strategies Top

Resource Management Strategies

***Resource Management Strategies** - Select all that apply:

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 & Groundwater Storage
☐ Recycled Municipal Wastewater
☐ 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 Management

Practice Resources Stewardship
☐ Agricultural Land Stewardship
☐ Ecosystem Restoration
☐ Forest Management
☐ Land Use Planning and Management
☐ Recharge Area Protection
☐ Sediment Management
☐ Watershed Management

People and Water
☐ Economic Incentives (Loans, Grants, and Water Pricing)
☐ Outreach and Engagment
☐ Water and Culture

☐ Water-Dependent Recreation

Other Strategies
☐ Crop Idling for Water Transfers
☐ Irrigated Land Retirement
☐ Rainfed Agriculture

Benefits and Impacts Top

Primary Benefit

Primary Benefit - Select one of the following: *
☐ Water Supply
☐ Water Quality
☐ Flood Management
☐ Environment
☐ Community Stewardship

Overall Benefits and Impacts

If the project involves phased/construction implementation, estimate benefits that will be realized following completion of each phase:

DAC, Native American, and Environmental Justice Benefits and Considerations

Does the project address a critical water supply or water quality need of a DAC? ☐ Yes ☐ No

The DAC status of communities may be determined using DWR's Water Management Planning Tool, available at https://gis.water.ca.gov/app/boundaries/. DACs may be identified at the census designated place, census tract, and/or block group level. A community may also be considered a DAC if an income survey has been completed demonstrating that the community meets DAC criteria (a median household income less than 80% of the California median household income).

If Yes, describe the need and how the project addresses it:

Identify specific DACs that will benefit from the project
☐ Atwater
☐ El Nido
☐ Franklin/Beachwood

- ☐ Le Grand
- ☐ Livingston
- ☐ Merced
- ☐ Planada
- ☐ Snelling
- ☐ Stevinson
- ☐ Winton

Environmental Justice

Environmental justice can be defined as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice seeks to redress inequitable distribution of environmental burdens (e.g. pollution, industrial facilities) and access to environmental goods (e.g. clean water and air, parks, recreation, nutritious foods, etc.).

Have the environmental justice impacts of the projects been evaluated? ☐ Yes ☐ No
If Yes, describe the potential impacts or benefits and efforts to mitigate environmental justice concerns:

Will the project address an existing environmental justice issue? ☐ Yes ☐ No
If Yes, describe the environmental justice issue and how the project will address it:

Native American Tribal Communities

Will the project benefit Federally- or State-recognized Native American tribal communities? ☐ Yes ☐ No
If Yes, describe how Native American Tribal communities will benefit:

Climate Change Adaption:

Climate change adaption includes activities to adjust to the actual or expected future climate.

Does the project help the water system adapt to vulnerabilities to climate change effects? ☐ Yes ☐ No
If Yes, describe how adaptation(s) are achieved:

Does the project provide adaptation to changes in the amount, intensity, timing, quality, and/or variability of runoff and recharge? ☐ Yes ☐ No
If Yes, describe how adaptation(s) are achieved:

Does the project provide an adaptation to sea level rise (either direct or indirect adaptations)? ☐ Yes ☐ No
If Yes, describe how adaptation(s) are achieved:

Climate Change Mitigation:

Climate change mitigation includes activities to reduce and stabilize the levels of greenhouse gases in the atmosphere.

Does the project reduce energy consumption and/or greenhouse gas emissions? ☐ Yes ☐ No
If Yes, describe how energy consumption or emissions are reduced:

Does the project consider the contribution of the project to reducing greenhouse gas emissions as compared to project alternatives? ☐ Yes ☐ No

If Yes, describe how this was considered:

Does the project consider the ability of the project to help the Merced Region reduce greenhouse gas emissions as new projects are implemented over the 20-year planning horizon? ☐ Yes ☐ No

If Yes, describe how this was considered:

Schedule and Budget [Top]

Project Status

Project Status: * Select

Schedule Details - Provide start and end dates for each of the following; if not applicable, please check N/A

Planning:	Start Date:		End Date:		N/A: ☐
Design/Engineering+:	Start Date:		End Date:		N/A: ☐
Environmental Documentation++:	Start Date:		End Date:		N/A: ☐
Permitting+++:	Start Date:		End Date:		N/A: ☐
Acquisition of Rights-of-Way++++:	Start Date:		End Date:		N/A: ☐
Development of Financing:	Start Date:		End Date:		N/A: ☐
Construction/Implementation+++++:	Start Date:		End Date:		N/A: ☐
Environmental Mitigation Efforts:	Start Date:		End Date:		N/A: ☐
Post Project Monitoring:	Start Date:		End Date:		N/A: ☐

+If design is currently underway, has the pre-design been completed? ☐ Yes ☐ No

++ Describe environmental documentation planned or required, e.g. ND, MND, EIS/EIR:

+++ Describe permits required for the project and note which permits have been obtained to date:

++++ Is the project located on public land? ☐ Yes ☐ No

If not, does the project have an easement or right-of-way agreement with a local landowner? ☐ Yes ☐ No

+++++ If project involves phased construction/implementation, provide start and end dates for each phase:

Project Schedule

Attach project workplan and/or schedule if available

File Name	**Description (relevancy,agency, weblink, date, etc.)**	**Type**

Project Costs

Estimated Project Cost: *

Project Cost Breakdown: *

☐ N/A ☐ Unknown ☐ Project Management:

☐ N/A ☐ Unknown ☐ Land Purchase/Easement:

☐ N/A ☐ Unknown ☐ Planning:

☐ N/A ☐ Unknown ☐ Environmental Documentation:

☐ N/A ☐ Unknown ☐ Construction/Implementation:

☐ N/A ☐ Unknown ☐ Environmental Mitigation/Compliance:

☐ N/A ☐ Unknown ☐ Construction Administration:

☐ N/A ☐ Unknown ☐ Annual Operations and Maintenance:

☐ N/A ☐ Unknown ☐ Other:

Specify Other:

Total (Not including Annual Operations and Maintenance): $0.00

Base Year for Costs (i.e., 2017 dollars?): *

Estimated Project Life (for infrastructure projects):

Click here for a list of general infrastructure life spans.

Economic Feasibility

Has a project economic analysis and/or benefit cost ratio been developed for the project? ☐ Yes ☐ No

Attach economic analysis and/or benefit cost ratio if available.

File Name	Description (relevancy,weblink, date, etc.)	Type

Project Funding

Is the project supported by entities that have created permanent, local, or regional funding? ☐ Yes ☐ No

Amount that will be funded from local cost match or in kind contributions:

Describe the source(s) of local funding match:

Amount of funding secured through existing grants:

Describe existing grant source(s):

Total estimated cost currently unfunded:

IRWM Program Consistency Top

Statewide Priorities

Select all that apply. For detailed information regarding the Statewide Priorities, see pages 8-11 of the 2016 IRWM Guidelines, available here:

- ☐ Make Conservation a California Way of Life
- ☐ Increase Regional Self-Reliance and Integrated Water Management Across All Levels of Government
- ☐ Achieve the Co-Equal Goals for the Delta
- ☐ Protect and Restore Important Ecosystems
- ☐ Manage and Prepare for Dry Periods
- ☐ Expand Water Storage Capacity and Improve Groundwater Management
- ☐ Provide Safe Water for All Communities
- ☐ Increase Flood Protection

Proposition 1 Project Eligibility

Is your project ready to be considered for Proposition 1 Implementation Grant? ☐ Yes ☐ No

Does your project contribute to addressing nitrate, arsenic, perchlorate, or hexavalent chromium contamination? ☐ Yes ☐ No

For urban water suppliers, do you have a 2015 Urban Water Management Plan that has been approved by DWR? If you are not an urban water supplier, check N/A.+ ☐ Yes ☐ No ☐ N/A

For urban water suppliers+, are you in compliance with the water meter requirements in the California Water Code? If you are not an urban water supplier, check N/A.+ ☐ Yes ☐ No ☐ N/A

For agricultural water suppliers++, are you implementing efficient water management practices as required by SBx7-7 and did you adopt an Agricultural Water Management Plan by December 31, 2015? If you are not an agricultural water supplier, check N/A.++ ☐ Yes ☐ No ☐ N/A

Are you in compliance with the groundwater management requirements listed on pages 11-12 of the 2016 IRWM Guidelines? (Refer to this PDF for requirements.) ☐ Yes ☐ No ☐ N/A

Are you in compliance with the California Statewide Groundwater Elevation Monitoring (CASGEM) requirements listed on page 12 of the 2016 IRWM Guidelines (Water Code §10920)? (Refer to this PDF for requirements.) ☐ Yes ☐ No ☐ N/A

For surface water diverters, are you in compliance with the California Water Code surface water diversion reporting requirements? If you are not surface water diverter, check N/A. ☐ Yes ☐ No ☐ N/A

+An urban water supplier is defined as a supplier providing water to more than 3,000 urban customers or supplying more than 3,000 acre-feet of water to urban customers.
++An agricultural water supplier is defined as a supplier providing water to 10,000 or more irrigated acres, excluding recycled water.

SWRP Program Consistency Top

SWRP Program Consistency

This section is only required for stormwater projects (i.e., if you checked the SWRP box in the Project Info section). If you are submitting your project only to the IRWMP, you can skip this section.

The primary purpose of the SWRP is to identify and assess projects that promote stormwater as a resource, prioritizing those multi-benefit projects that can best meet the identified planning area and watershed priorities. All stormwater and dry weather runoff capture projects must now be included in a SWRP to be eligible for state grant funding; projects included in the SWRP may be eligible to apply for upcoming funding opportunities.

SWRP Project Eligibility

Each project must meet all of the following to be included in the SWRP.
Can the Project be sponsored by an eligible applicant? ☐ Yes ☐ No
Is the project a storm water or dry weather runoff project? ☐ Yes ☐ No
Does the project meet 2 or more of the following SWRP Main Benefits? ☐ Yes ☐ No

Water Quality - Increased filtration and/or treatment of runoff Water Supply - Water supply reliability Water Supply - Conjunctive use Flood Management - Decreased flood risk by reducing runoff rate and/or volume Environmental - Environmental and habitat protection and/or improvement Environmental - Increased urban green space Community - Employment opportunities provided Community - Public education

Does the project meet at least one of the following SWRP Additional Benefits? ☐ Yes ☐ No
Water Quality - Nonpoint source pollution control Water Quality - Reestablished natural water drainage and treatment Water Supply - Water conservation Flood Management - Reduced sanitary sewer overflow Environmental - Reduced energy use, greenhouse gas emissions, or provides a carbon sink Environmental - Reestablishment of natural hydrograph Environmental - Water temperature improvements Community - Community involvement Community - Enhance and/or create recreational and public use areas

Merced Regional Watershed Priorities

Does the Project implement water quality improvements to help achieve the goals of an existing TMDL? (check all that apply)
☐ Sacramento-San Joaquin Delta Mercury and Methylmercury TMDL
☐ San Joaquin River Dissolved Oxygen TMDL
☐ Lower San Joaquin River Salt and Boron TMDL
☐ Lower San Joaquin River Diazinon and Chlorpyrifos TMDL; Sacramento-San Joaquin Delta Diazinon and Chlorpyrifos TMDL; Central Valley Pesticide TMDL

Does the project reduce pollutant discharges into a 303(d) listed Impaired Water Body? ? (The current 303(d) list, as of July 2018, can be found on the State Water Resources Control Board website here: https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml)
☐ Yes ☐ No

If Yes, please list water body:

Does the project augment water supply by capturing storm water for recharging into a groundwater basin? ☐ Yes ☐ No

Does the Project provide a SWRP Main or Additional Benefit (listed above) to a disadvantaged community or economically distressed area? ☐ Yes ☐ No

If Yes, please list communities:

Is the project compliant with the conditions of applicable NPDES permits? ☐ Yes ☐ No

SWRP Benefits Top

SWRP Benefits

This section is only required for stormwater projects (i.e., if you checked the SWRP box in the Project Info section). If you are submitting your project only to the IRWMP, you can skip this section.

Water Quality Benefits

Does the project provide any of the following benefits (check all that apply and provide applicable quantitative estimate, if available):

☐ Increased filtration and/or treatment of runoff (SWRP Main Benefit)

Average annual pollutant load reduction:

TSS (lbs/yr):

Mercury (lbs/yr):

Diazinon (lbs/yr):

Chlorpyrifos (lbs/yr):

Selenium (lbs/yr):

Diuron (lbs/yr):

Bacteria - fecal coli. / E. coli (MPN/yr):

Pyrethroids (lbs/yr):

Trash (lbs/yr):

Total nitrogen (lbs/yr):

Other constituent (insert metric):

Volume of water treated (mgd):

Volume of runoff infiltrated (AF/year):

Other quantitative metric:

☐ Nonpoint source pollution control (SWRP Additional Benefit)

Provide qualitative metric:

☐ Reestablished natural water drainage and treatment (SWRP Additional Benefit)

Provide quantitative metric:

Describe how the project will achieve these benefits (description is required if any of the above benefits are selected):

Describe the method or study used to quantify the benefits described above (description is required if a quantitative estimate was provided):

Water Supply Benefits

Does the project provide any of the following benefits (check all that apply and provide applicable quantitative estimate, if available):

☐ Water supply reliability (SWRP Main Benefit)

Increase in water supply through direct groundwater recharge (af/year):

Increase in water supply through direct use (af/year):

Other quantitative metric:

☐ Conjunctive use (SWRP Main Benefit)

Increase in water supply though in lieu recharge/conjunctive use (af/year):

Other quantitative metric:

☐ Water conservation (SWRP Additional Benefit)

Reduction in water use (af/year):

Other quantitative metric:

Describe how the project will achieve these benefits (description is required if any of the above benefits are selected):

Describe the method or study used to quantify the benefits described above (description is required if a quantitative estimate was provided):

Flood Management Benefits

Does the project provide any of the following benefits (check all that apply and provide applicable quantitative estimate, if available):

☐ Decreased flood risk by reducing runoff rate and/or volume (SWRP Main Benefit)

Reduction in peak flow discharge (cfs):

Reduction in volume of potential flood water (af/year):

Other quantitative metric:

☐ Reduced sanitary sewer overflows (SWRP Additional Benefit)

Reduction in sewer overflow volumes (af/year):

Other quantitative metric:

Describe how the project will achieve these benefits (description is required if any of the above benefits are selected):

Describe the method or study used to quantify the benefits described above (description is required if a quantitative estimate was provided):

Environmental Benefits

Does the project provide any of the following benefits (check all that apply and provide applicable quantitative estimate, if available):

☐ Environmental habitat protection and improvement, including wetland enhancement/creation, riparian enhancement, and/or instream flow improvement (SWRP Main Benefit)

Size of habitat protected or improved (acres):

Amount of instream flow rate improvement (cfs):

Other quantitative metric:

☐ Increased urban green space (SWRP Main Benefit)

Size of increase in urban green space (acres):

Other quantitative metric:

☐ Reduced energy use, greenhouse gas emissions, or provides a carbon sink (SWRP Additional Benefit)

Amount of energy consumption reduced (KWH/year):

Amount of GHG emissions reduced (tons/year):

Other quantitative metric:

☐ Reestablishment of natural hydrograph (SWRP Additional Benefit)

Provide quantitative metric:

☐ Water temperature improvements (SWRP Additional Benefit)

Amount of temperature improvement (degrees F):

Describe how the project will achieve these benefits (description is required if any of the above benefits are selected):

Describe the method or study used to quantify the benefits described above (description is required if a quantitative estimate was provided):

Community Benefits

Does the project provide any of the following benefits (check all that apply and provide applicable quantitative estimate, if available):

☐ Employment opportunities provided (SWRP Main Benefit)

Number of employment opportunities provided:

Other quantitative metric:

☐ Public education (SWRP Main Benefit)

Number of outreach materials provided or events conducted:

Other quantitative metric:

☐ Community involvement (SWRP Additional Benefit)

Number of participants per year:

Other quantitative metric:

* Minimum Required Information for Project Submission

☐ Enhance and/or create recreational and public use areas (SWRP Additional Benefit)

Estimated visits per year:

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Other quantitative metric:

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☐ Create or restore habitat, open space, parks, recreation or green open space in a DAC with a deficit of such spaces (Other Benefit)

- -

Area of habitat restored, open space created, etc:

Other quantitative metric:

Describe how the project will achieve these benefits (description is required if any of the above benefits are selected):

Describe the method or study used to quantify the benefits described above (description is required if a quantitative estimate was provided):

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