Draft San Diego Regional Agricultural Water Management Plan Part I

January 2016

Prepared for:

San Diego County Farm Bureau

SAN DIEGO COUNTY FARM BUREAU

Prepared by:

Ken Weinberg Water Resources Consulting LLC

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Cover Photo Credit: County of San Diego General Plan, Chapter 2 Visioning Document

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on behalf of the following Participating Agencies

- **Valley Center Municipal Water District**
- **Rainbow Municipal Water District**
- **Carlsbad Municipal Water District**
- **City of Escondido**
- **City of Oceanside**
- **City of Poway**
- **Fallbrook Public Utilities District**
- **Olivenhain Municipal Water District**
- **Ramona Municipal Water District**
- **Rincon del Diablo Municipal Water District**
- **San Dieguito Water District**
- **Santa Fe Irrigation District**
- **Vallecitos Water District**
- **Yuima Municipal Water District**

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Acronyms and Abbreviations

Mg/l	**micrograms per liter**
°F	**degrees Fahrenheit**
2005 Plan	**Updated 2005 Urban Water Management Plan**
2010 Plan	**2010 Urban Water Management Plan**
AAC	**All-American Canal**
AB	**Assembly Bill**
AF or af	**Acre Feet**
AF/YR	**acre-feet per year**
AMR	**Automatic Meter Reading**
Avg.	**average**
AWMP	**Agriculture Water Management Program**
AWWA	**American Water Works Association**
BDCP	**Bay Delta Conservation Plan**
BiOp	**Biological Opinion**
BMPs	**Best Management Practices**
Board	**Board of Directors**
CC	**Coachella Canal**
CCR	**California Code of Regulations**
CDFG	**California Department of Fish and Game**
CEQA	**California Environmental Quality Act**
cfs	**cubic feet per second**
CII	**commercial, industrial, and institutional**
CIMIS	**California Irrigation Management Information System**
CIP	**Capital Improvement Program**
CMWD	**Carlsbad Municipal Water District**
CO2	**carbon dioxide**
CRA	**Colorado River Aqueduct**
CSP	**Carryover Storage Project**
CUWCC	**California Urban Water Conservation Council**
CVP	**Central Valley Project**
CVWD	**Coachella Valley Water District**
D/DBP	**Disinfectants/ Disinfection Byproducts**
DBPs	**Disinfection byproducts**
DDW	**Division of Drinking Water State Water Resources Control Board**

Delta	**Sacramento-San Joaquin River Delta**
DWR	**California Department of Water Resources**
EDU	**Equivalent Dwelling Unit**
EIR	**Environmental Impact Report**
EIS	**Environment impact statement**
EPA	**U. S. Environmental Protection Agency**
ESA	**Endangered Species Acts**
ESP	**Emergency Storage Project**
ET	**Evapotranspiration**
ETC	**Crop Evapotranspiration**
ET0	**Reference Evapotranspiration**
EWMP	**Efficient Water Management Practice**
Forum	**Colorado River Basin Salinity Control Forum**
FPUD	**Fallbrook Public Utilities District**
GCM	**General Circulation Model**
GIS	**geographic information system**
GPCD	**Gallons per capita per day**
gpm	**Gallons per minute**
hcf	**Hundred Cubic Feet**
IAC	**San Diego County Water Authority Infrastructure Access Charge**
ID	**Irrigation District**
IID	**Imperial Irrigation District**
IPCC	**Intergovernmental Panel on Climate Change**
IPR	**Indirect Potable Reuse**
Ib/day	**pounds per day**
M&I	**Municipal and Industrial**
MAIN	**Municipal and Industrial Needs**
mg/l	**milligrams per liter**
MGD	**million gallons per day**
MRCD	**Mission Resource Conservation District**
MOU	**Memorandum of Understanding**
MSL	**Mean Sea Level**

MWD	**Municipal Water District of Southern California**
MTBE	**Methyl Tertiary Butyl Ether**
MW	**megawatts**
MWD	**Municipal Water District**
NCCP	**Natural Community Conservation Plan**
NOAA	**National Oceanic and Atmospheric Administration**
NPDES	**National Pollutant Discharge Elimination System**
OMWD	**Olivenhain Municipal Water District**
pCi/l	**picocuries per liter**
PL	**Public Law**
Poseidon	**Poseidon Resources**
ppm	**parts per million**
QSA	**Quantification Settlement Agreement**
RAWMP	**Regional Agricultural Water Management Plan**
RMWD	**Rainbow Municipal Water District**
Regional Board	**Regional Water Quality Control Board**
RO	**reverse osmosis**
ROD	**Record of Decision**
RSF	**Rate Stabilization Fund**
RUWMP	**Regional Urban Water Management Plan**
RWMG	**Regional Water Management Group**
SANDAG	**San Diego Association of Governments**
SCADA	**Supervisory Control and Data Acquisition**
SNMP	**Salt Nutrient Management Plan**
SWRCB	**State Water Resources Control Board**

TSAWR	**Transitional Special Agricultural Water Rate**
SB	**Senate Bill**
SBX7-7	**Senate Bill 7 of the Seventh Extraordinary Session of 2009 (Water Code §10608); also known as Water Conservation Act of 2009**
SCSC	**Southern California Salinity Coalition**
SDCWA	**San Diego County Water Authority**
SDWA	**Safe Drinking Water Act**
SDWD	**San Dieguito Water District**
SFID	**Santa Fe Irrigation District**
SWA	**Source Water Assessment**
SWP	**State Water Project**
SWRCB	**State Water Resources Control Board**
TDS	**total dissolved solids**
TOC	**total organic carbon**
Transfer Agreement	**Water Authority-IID Water Conservation and Transfer Agreement**
USBR	**U.S. Bureau of Reclamation**
USFWS	**U.S. Fish and Wildlife Service**
USGS	**United States Geological Survey**
UWMP	**Urban Water Management Plan**
VWD	**Vallecitos Water District**
VCMWD	**Valley Center Municipal Water District**

WSAP	**Water Supply Allocation plan**
WSDM	**Water Surplus and Drought Management**
WSDRP	**Water Shortage and Drought Response Plan**
WTP	**Water Treatment Plant**
WUCA	**Water Utility Climate Alliance**
YMWD	**Yuima Municipal Water District**

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0 Preface to Part I Regional Planning

San Diego County is the second most populous county in California with 3.2 million people and home to the second largest city in the state. It is also the terminus of the most complex imported water system in the world, the last point of delivery for Colorado River and State Water Project water. It is literally at the end of the pipeline. San Diego County, more than any other area of urban southern California has seen its population and its economy grow over a sixty-year period almost solely due to the availability of water imported from hundreds of miles away.

Despite its highly urbanized image San Diego County also has a long and rich agricultural history and is unique in urban southern California in continuing to maintain a vibrant and profitable commercial agriculture economy. Agricultural areas of today's San Diego County are cultivating lands that can trace their commercial agricultural origins to Mexican Land Grants of the 1840's and homesteaders of the 1860s. As recently as the early 2000's commercial agriculture accounted for over 100,000 acre feet or 15% of the region's imported water use. Although reduced by rapidly increasing water rates, imported supply shortages and other economic factors agriculture still uses 8-10% or the region's water.

Agriculture in San Diego County contributes economically, environmentally and to the quality of life by maintaining land in non-urban uses and buffering suburban sprawl. Farmers are stewards of the land who contribute to the quality of the environment by controlling soil erosion and run-off into sensitive watersheds. Urban San Diegans enjoy the close juxtaposition of agricultural and urban development observed in the region. In San Diego, agriculture is not the farm on the other side of the county, but is the greenhouses, flower and vegetable fields and small groves in and near urban neighborhoods. Agriculture adds a refreshing quality of life and economic opportunity to urban as well as rural residents. This is illustrated in the many local governmental policies that municipalities

SAN DIEGO COUNTY AGRICULTURE IS A $1.8 BILLION DOLLAR PER YEAR INDUSTRY, AND RANKS FIRST IN THE STATE IN GROSS VALUE OF AGRICULTURAL PRODUCTION FOR FLOWERS, FOLIAGE, AND NURSERY PRODUCTS.

and County government have adopted to maintain and foster an on-going agricultural sector in the region.

Although the total number of agricultural acres under production has declined, the region maintains a significant number of high value crops, such as cut-flowers, ornamental trees and shrubs, nursery plants, avocados, and citrus. Based on the 2014 Crop Statistics and Annual Report by the San Diego County Department of Agricultural Weights and Measures, the region has 5,732 farms, more than any other county in the United States. 68% of San Diego County farms are 1-9 acres.

San Diego County agriculture is a $1.8 billion dollar per year industry, and ranks first in the state in gross value of agricultural production for flowers, foliage, and nursery products. Statewide, San Diego County is in the top five counties for Nursery Products, Oranges, Chickens, Flowers & Foliage, Tomatoes (Fresh Market), Lemons, Avocados, Eggs (Chicken), Mushrooms, and Grapefruit. San Diego County farmers produce more than 37 commodities, that are valued in excess of $1 million dollars each.

0.1 San Diego Regional Agricultural Water Management Plan

The San Diego Regional Agricultural Water Management Plan (RAWMP) is a cooperative effort of the San Diego County Farm Bureau (SDCFB) and fourteen retail water agencies that serve commercial agricultural customers in the northern half of San Diego County. The purpose of this RAWMP is to comply with requirements of the State Water Resources Control Board in their May 15, 2015 *Emergency Regulation For Statewide Urban Water Conservation* that urban water suppliers may deduct commercial agricultural deliveries from their agency's conservation target if they:

"Comply *with the Agricultural Water Management Plan requirement of paragraph 12 of the April 1, 2015 Executive Order for all commercial agricultural water served by the supplier that is subtracted from its total potable water production."*

Although thirteen of the fourteen agencies participating in the RAWMP prepare Urban Water Management Plans (UWMP), (Yuima Municipal Water District is not required to prepare an UWMP) it is also a purpose of the San Diego RAWMP to highlight the efficient water management practices of these agricultural water customers and these agencies as a whole. It is important to note that these water suppliers implement efficient water management practices that benefit the entire system that serves both M&I user's and agricultural customers. Efficient water use and diversification of supplies regionally by SDCWA and locally by individual retail water agencies enhance water reliability of all customers within the region.

While these agencies are committed to water conservation and are meeting their state mandated 20% reduction in gallon per capita day (GPCD) consumption, their agricultural customers are among the most efficient in the state. It is also important to recognize that commercial agriculture in San Diego County is unique in its financial challenges. Not only is efficient water use an ethic in San Diego County, it is a financial necessity for farmers paying $1,300 to upwards of $1500/acre foot for water. San Diego County agriculture has adapted as best it can to these economic headwinds, the pressures of increasing urbanization and water supply availability. San Diego County agriculture is expected to continue to maintain its almost $2 billion economic value and its high ranking among California agricultural counties.

The current severe 4-year state-wide drought has only reinforced the continued need to meet those ongoing challenges in water supply availability and economic pressures. Recognition by the SWRCB that commercial agriculture in San Diego County is an important contributor to the region's economy shows it to be one of many other counties in California with strong agricultural sectors. Agriculture in San Diego County has responded to this drought as they have to previous droughts with reductions in water use and continued implementation of efficient water management practices.

Avocados

San Diego County has the largest domestic avocado producers in the US. The 2014 Crop Statistics and Annual Report by the San Diego County Department of Agricultural Weights and Measures, lists Avocados as the commodity with the *Greatest Amount of Planted Acreage* with a crop value of $154 Million. Because avocados are water-dependent, they continue to be affected by the ongoing drought.

0.2 San Diego County Farm Bureau

The San Diego County Farm Bureau (SDCFB) is a non-profit membership organization founded in 1914 to promote and protect agriculture. The San Diego County Farm Bureau was one of the earliest farm bureaus organized in the state. The movement in the United States being about two years old at that time. The first formal meeting was held on Feb 20, 1914 at the Spreckels Theater in San Diego. Today the SDCFB is supported solely by more than 5,000 dues-paying members. Its Mission Statement is:

"The mission of the Farm Bureau of San Diego County is to represent San Diego agriculture through public relations, education, and public policy advocacy in order to promote the economic viability of agriculture balanced with appropriate management of natural resources."

In San Diego County, the Farm Bureau is the leading advocate for the farm community and works with elected officials, government agencies, educators, the public, and the media. Local Farm Bureau membership reaches well beyond the boundaries of the county. Because of the importance and challenges of water to local agriculture the SDCFB has long been involved in water supply, water pricing and water reliability issues. As water is of primary importance to its members, the SDCFB has served as not only an advocate on water supply issues but has worked for many years closely with the SDCWA and the retail water agencies serving agricultural customers. Working in tandem with the region's water suppliers the SDCFB requested that the SWRCB acknowledge in its Emergency Regulation that San Diego County commercial agriculture faces the same economic imperatives as commercial agriculture in other parts of the California. That request resulted in the provisions of the Emergency Regulation described above.

Although Agricultural Water Management Plans are typically prepared by public water suppliers, in this instance the SDCFB's long involvement in water supply issues and its close working relationship with the region's water suppliers provided an opportunity to coordinate the activities of the fourteen agencies and take the lead in preparing this RAWMP.

0.3 San Diego Agriculture and Imported Water: Historic Perspective

Prior to the Second World War San Diego County was overshadowed by its neighbor to the north Los Angeles, as a manufacturing and shipping center and its economy reflected the residential, tourist and agricultural nature of the region. Unprecedented growth began with World War II and San Diego's strategic location as a center of naval operations and the war's industrial effort. With the population and economic boom brought about by the war effort it became clear that the problem of water availability needed to be addressed immediately. San Diego civic leaders had debated since the 1920's whether to bring Colorado River water to the City as an independent supply or later as a member of the Metropolitan Water District of Southern California (MWD).

> *MWD WAS MOTIVATED TO FILL ITS PIPELINES AND SELL WATER TO INCREASE AND DIVERSIFY ITS REVENUE SOURCES. THIS LED TO THE EXPANSION OF MWD'S SERVICE AREA TO INCLUDE ANNEXATIONS OF PRIMARILY AGRICULTURAL WATER SUPPLIERS IN SAN DIEGO*

The federal government, as a matter of national security, stepped in to bring imported water to the region from the newly completed Colorado River Aqueduct (CRA) and its terminus in southern Riverside County. The San Diego County Water Authority (SDCWA) was formed and the region became part of the MWD.

The annexation of SDCWA to MWD signaled a change in the role of MWD as the supplemental supplier for Municipal and Industrial water needs of cities in the southern California coastal plain. San Diego County was largely agricultural as were later additions to MWD in Orange, Riverside, San

Bernardino and Ventura counties. While MWD's founding agencies were cities that had their own local supplies, MWDs Colorado River Aqueduct (CRA) had the capacity to import much more water than the cities that made up MWD required. With its debt on the CRA and its other facilities serviced by property tax assessments on its member agencies MWD was motivated to fill its pipelines and sell water to increase and diversify its revenue sources. This led to the expansion of MWD's service area to include annexations of primarily agricultural water suppliers in San Diego County.

Many of the water agencies participating in this RAWMP were formed to purchase imported Colorado River Water from MWD through SDCWA for the use of commercial agricultural customers. Because MWD received most of its revenues from property taxes this allowed for very favorable and discounted water pricing which in turn resulted in increased revenues for MWD and the substantial expansion of commercial agriculture in areas that had little or no local surface or groundwater supplies (See Part II Chapters). MWD's Laguna Declaration in 1952 that it would ensure it served the growing and expanding needs of its members was a boon to commercial agriculture in the region. When MWD's then largest agency, the City of Los Angeles decided to build a second barrel of the Los Angeles Aqueduct to increase its Owens Valley water supply, expansion of agricultural water use only grew in importance as an immediate revenue source along with continued population growth and development in the urban areas of the MWD service area.

Although agricultural water use was an important revenue source, MWD maintained its primary long term commitment to serve M&I users. Up until 1999 agricultural water deliveries were considered by MWD under its enabling legislation to be surplus water. That meant that it was only after M&I needs had been served was water available to agriculture. Because it was a surplus use of water and considered an interruptible supply, agricultural water was priced by MWD at a sizeable discount. As long as there was ample water supply the arrangement worked for all. A strong agricultural economy in San Diego County was maintained on the foundation of readily available and inexpensive water for the next four decades. Conditions did not change until the reliability and affordability of imported supplies changed radically in the state-wide drought of 1987-1992, never more so than at the end of the pipeline in San Diego County.

0.4 Water Use Efficiency and Supply Diversification

The San Diego region was 95% dependent on imported water during the drought of 1987-1992. If not for the Miracle March rains of the winter of 1991 agricultural customers were facing 90% cutbacks while M&I users were expecting a 50% reduction in water supply. Even with improved conditions agricultural and M&I users experienced a blended 31% cutback. It was a blended cutback because the Board of Directors of the SDCWA and its member agencies' understood that it was in the regional economy's best interest to reduce the impact to agriculture of potentially catastrophic cutbacks. There was also recognition that agriculture was part of the fabric of the community and an important part of region's identity.

The experience of that drought resulted in a regional strategy to improve water reliability through aggressive implementation of water conservation for both M&I and agricultural customers as well as a successful commitment to a program of supply diversification. Developing local supplies like recycled water, recovering brackish groundwater and most recently desalinated seawater has provided drought proof supplies for the region and reduced the demand for less reliable imported supplies. SDCWA's agricultural water transfer with the Imperial Irrigation District and conserved water from the lining of the All American and Coachella Canals has diversified the sources of imported water and improved the reliability of the entire region. Device based and behavioral conservation has reduced gpcd by approximately 25% from 1991 levels while the region is using similar amounts of supply while adding 750,000 people.

The region's commercial farmers are among the most efficient in the state because they must to be successful and profitable. In exchange for a reduced price of water many commercial growers provide a reliability benefit back to the M&I users by taking deeper cutbacks during shortage allocation and providing more water to the M&I sector. The region's advances in reliability and water efficiency benefit all the water users in the region, and that has proven to be the most effective response to drought and water shortages.

0.5 Plan Organization

The San Diego RAWMP consists of 2 volumes, Part I and Part II. Part I addresses the Plan requirements from a regional perspective. Part I relies heavily on regional planning documents including the SDCWA's 2010 UWMP, the San Diego 2013 Integrated Regional Water Management Plan (IRWM Plan) and County of San Diego General Plan documents. Part II provides agency specific information on AWMP requirements for the 14 water suppliers participating in this RAWMP. Part II is based on retail agency 2010 UWMPs and where conducted Water and Waste Water Master Plans. Part II is organized with the two largest agricultural water suppliers listed first and then the remaining water suppliers appearing in alphabetical order.

When combining the information in Part I and Part II, the reader will be provided a good understanding of the interconnectedness of the region's water supplies and inter-agency coordination of water management strategies as well as a perspective of the unique and vibrant agricultural tradition the San Diego region maintains today.

0.6 Acknowledgements

Eric Larsen, Executive Director of the SDCFB and its Board of Directors for taking on the lead role in AWMP preparation, Kim Thorner, General Manager of the Olivenhain Municipal Water District for initially organizing the 14 agencies and the SDCFB to develop the Plan, to all the General Managers and staff of the 14 retail water agencies that all worked hard to provide data, graphics and tables and reviewed the individual chapters of this RAWMP during production. Appreciation to Dana Friehauf, Tim Bombardier and Stu Williams of the Water Resources Department staff of the San Diego County Water Authority (SDCWA) for providing graphics, data and expert review of key regional sections of Part I. Also, Gary Arant, General Manager of the Valley Center Municipal Water District and its Board of Directors for accepting the responsibility of being the agency of record for approving the RAWMP and for sharing their extensive experience and knowledge of water and San Diego County agriculture. Finally, appreciation to the DWR staff who provided advice and guidance to urban water planners on how to prepare an Agricultural Water Management Plan.

SOURCES

San Diego County Water Authority (SDCWA) .2001. *San Diego County Agricultural Water Management Plan*

Gottlieb, Robert. 2007. *Reinventing Los Angeles: Nature and Community in the Global City*. The MIT Press

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1. Introduction

Regional Planning

Draft San Diego Regional Agricultural
Water Management Plan: Part I

1 Introduction

1.1 Overview

The *San Diego County Regional Agricultural Water Management Plan* (SDRAWMP) has been prepared by the San Diego County Farm Bureau (SDCFB) and 14 participating San Diego County retail water agencies serving commercial agricultural water users within the service area of the San Diego County Water Authority (SDCWA). The RAWMP describes the water supply and water use efficiency planning and implementation activity of 14 retail water agencies in San Diego County for the purpose of providing reliable water supply to agricultural customers. The combined service areas of the 14 participating agencies total 380,000 acres of which 44,210 acres includes irrigated agricultural lands. The participating agencies are urban water suppliers located in the northern half of San Diego County. Of the 14 participating agencies, 4 agencies (Valley Center MWD, Rainbow MWD, Fallbrook PUD and Yuima MWD) serve at least 50% or more of their water supplies to agricultural customers.

With limited precipitation and local water sources, agriculture within the Region is dependent on imported water as the primary regional supply. All of the participating agencies deliver a combination of imported water from the State Water Project (SWP) and the Colorado River and in December 2016 will add desalinated seawater from the Carlsbad Desalination Project to their regional water supplies. Some of the agencies also own local surface water supplies, recycled water, pump and treat groundwater and recover brackish groundwater. Two of the participating agencies will be receiving additional desalinated seawater from the Carlsbad Desalination Project as their own local supply. As required by local and state health officials' agricultural water users receiving municipal supplies for both domestic and irrigation uses are delivered water meeting all state and federal drinking water standards. The only exceptions are agencies delivering recycled water to commercial nurseries and growers and one agency capable of delivering untreated imported water from a locally owned reservoir and conveyed to customers through a separate non-potable distribution system. In addition, some agricultural water users within some of the participating agencies provide their own irrigation water through groundwater pumping from privately owned wells.

1.2 Plan Approach

The San Diego RAWMP has been prepared in accordance with the requirements of the Water Conservation Act of 2009 (SBx7-7), which modifies Division 6 of the California Water Code (CWC or Code), adding Part 2.55 (commencing with §10608) and replacing Part 2.8 (commencing with §10800). This AWMP document conforms to the framework presented in ***A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2015 Agricultural Water Management Plan*** (Guidebook) that was issued by the California Department of Water Resources Division of Statewide Integrated Water Management Water Use and Efficiency Branch (DWR) in June, 2015 to aid water suppliers in preparing AWMPs in accordance with the requirements of SBx7-7.

Since all but one of the 14 participating agencies prepares Urban Water Management Plans (UWMPs), it is the intent of the RAWMP to be consistent with those documents. At the suggestion of DWR staff the RAWMP utilizes information from those UWMPs to avoid unnecessary duplication. This RAWMP relies heavily on information contained in the 2010 updates to the participating agencies *Urban Water Management Plans* (UWMPs) and the for regional information the SDCWA's 2010 UWMP and the 2013 *San Diego Integrated Regional Water Management Plan* (IRWM Plan). This RAWMP also uses information from monthly and annual reports from the participating agencies and the regional water wholesaler, SDCWA, information based on the County of San Diego General Plan and supporting documents and various public regional plans and studies conducted over time. Major sources of information are cited at the end of each Section.

The past studies and this RAWMP are collectively intended as documentation of the Region's efficient water management practices, the efficient distribution and use of the Region's water supplies, and as a guide for the development of additional water sources.

1.3 Participating Entities

The San Diego County RAWMP is being prepared by the *San Diego County Farm Bureau* (SDCFB) in cooperation with the following retail water suppliers:

Carlsbad Municipal Water District

City of Escondido

City of Oceanside

City of Poway

Fallbrook Public Utilities District

Olivenhain Municipal Water District

Rainbow Municipal Water District

Ramona Municipal Water District

Rincon del Diablo Municipal Water District

San Dieguito Water District

Santa Fe Irrigation District

Vallecitos Water District

Valley Center Municipal Water District

Yuima Municipal Water District

The general location and service area of the 15 participating agencies are shown on Figure 1-1.

1.4 Purpose

1.4.1 Background on Requirement for San Diego RAWMP

On April 1, 2015, Governor Brown issued the fourth in a series of Executive Orders on actions necessary to address California's severe drought conditions, which directed the State Water Board to implement mandatory water reductions in urban areas to reduce potable urban water usage by 25 percent statewide. On May 5, 2015, the State Water Board adopted an Emergency Regulation For Statewide Urban Water Conservation (Emergency Conservation Regulation) in accordance with the Governor's directive. The provisions of the Emergency Conservation Regulation went into effect on May 18, 2015. The Emergency Conservation Regulation provided an exemption for commercial agriculture being served by urban water suppliers and stated:

> *"(e) (1) Each urban water supplier that provides potable water for commercial agricultural use meeting the definition of Government Code section 51201, subdivision (b), may subtract the amount of water provided for commercial agricultural use from its potable water*

> *production total, provided that any urban water supplier that subtracts any water provided for commercial agricultural use from its total potable water production shall:*
>
> *(A) Impose reductions determined locally appropriate by the urban water supplier, after considering the applicable urban water supplier conservation standard specified in subdivision (c), for commercial agricultural users meeting the definition of Government Code section 51201, subdivision (b) served by the supplier;*
> *(B) Report its total potable water production pursuant to subdivision (b)(2) of this section, the total amount of water supplied for commercial agricultural use, and shall identify the reduction imposed on its commercial agricultural users and each recipient of potable water for commercial agricultural use;*
> *(C) Certify that the agricultural uses it serves meet the definition of Government Code section 51201, subdivision (b); and*
> *(D) Comply with the Agricultural Water Management Plan requirement of paragraph 12 of the April 1, 2015 Executive Order for all commercial agricultural water served by the supplier that is subtracted from its total potable water production."*

The purpose of this RAWMP is to comply with Paragraph e (1) (D) of the Emergency Conservation Regulation and Paragraph 12 of the Governor's April 1, 2015 Executive Order which states:

> *"12. Agricultural water suppliers that supply water to more than 25,000 acres shall include in their required 2015 Agricultural Water Management Plans a detailed drought management plan that describes the actions and measures the supplier will take to manage water demand during drought. The Department shall require those plans to include quantification of water supplies and demands for 2013, 2014, and 2015 to the extent data is available. The Department will provide technical assistance to water suppliers in preparing the plans."*

As noted above, the 14 participating agencies in the RAWMP are urban water suppliers that serve commercial agricultural customers meeting the definition of "agricultural use" in Government Code section 51201 which states:

"*Agricultural use" means use of land, including but not limited to greenhouses, for the purpose of producing an agricultural commodity for commercial purposes"*

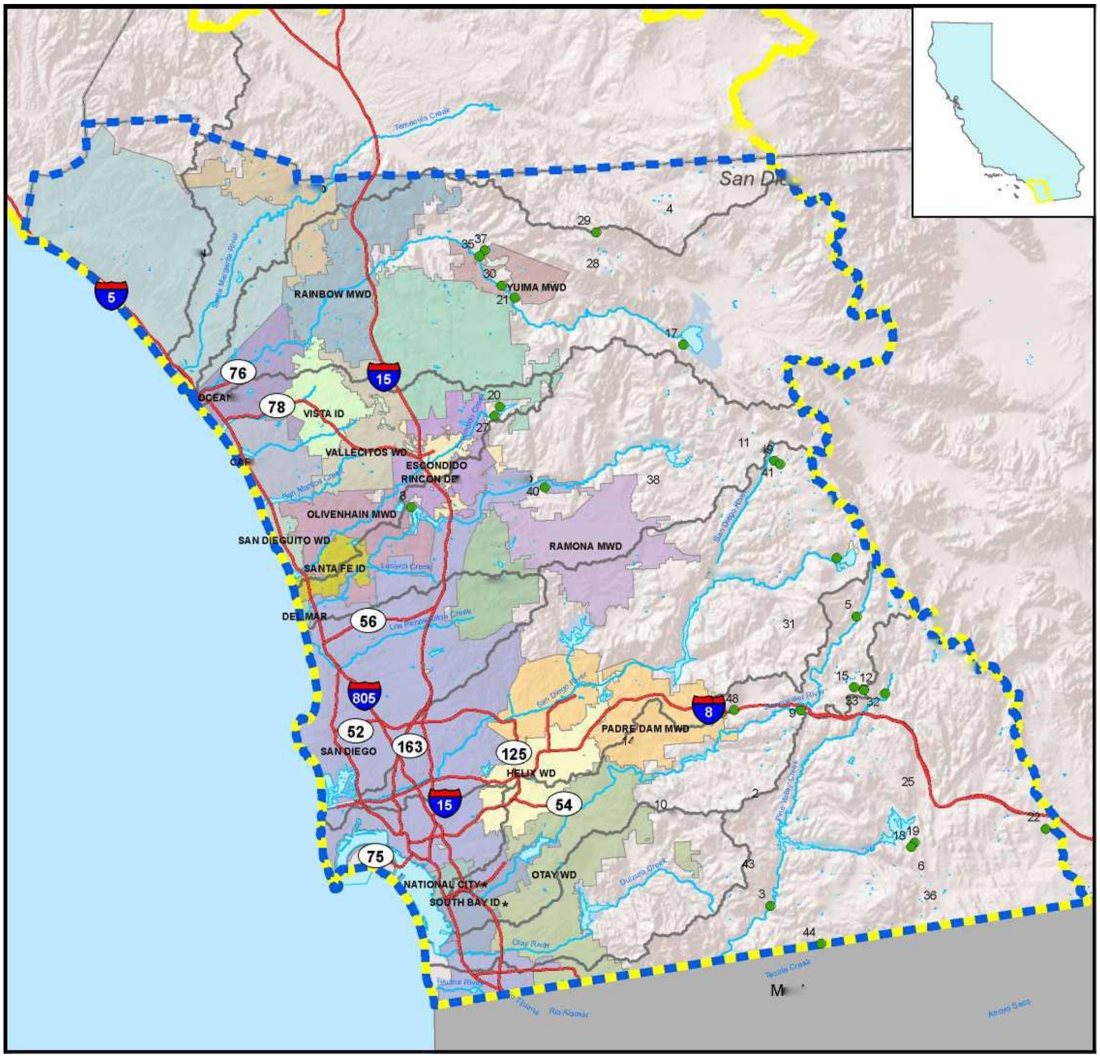
Thirteen of the fourteen agencies participating in the RAWMP have prepared UWMPs and intend to prepare a 2015 update to their individual plans to be approved and submitted to DWR by June 2016. One of the agencies, Yuima Municipal Water District, is not required to prepare an UWMP or an AWMP. Only two of the water suppliers, Valley Center Municipal Water District (VCMWD) and Rainbow Municipal Water District (RMWD) serve irrigated agricultural acreage in excess of 10,000 acres.

Paragraph 13 of the Governor's April 1, 2015 Executive Order requires:

"Agricultural water suppliers that supply water to 10,000 to 25,000 acres of irrigated lands shall develop Agricultural Water Management Plans and submit the plans to the Department by July 1, 2016. These plans shall include a detailed drought management plan and quantification of water supplies and demands in 2013, 2014, and 2015, to the extent that data is available. The Department shall give priority in grant funding to agricultural water suppliers that supply water to 10,000 to 25,000 acres of land for development and implementation of Agricultural Water Management Plans."

Although VCMWD and RMWD intend to develop and approve 2015 updates to their respective UWMPs they are also participating in the RAWMP as the San Diego region's largest agricultural water suppliers. Table 1-1 provides the listing of those agencies that have prepared a 2010 UWMP and are in the process of preparing a 2015 update to the UWMP.

Figure 1-1 RAWMP Planning Area



1.4.2 Plan Development

The San Diego RAWMP describes and documents the San Diego Region's existing and proposed water management programs and activities that affect the water use efficiency of agricultural users. In addition, the RAWMP is used to assess compliance with the requirements of the SBx7-7, the Agricultural Water Management Planning Act (Section I, Part 2.8, Division 6 (commencing at Section 10800) of the Water Code), and the subsequent Agricultural Water Measurement Regulation requirements (described in Title 23 California Code of regulations), notwithstanding such regulations go beyond that required by the statute and in many instances are not applicable to areas such as the agencies within the San Diego region.

SBx7-7 includes *Efficient Water Management Practices* (EWMPs) intended for agricultural water suppliers to document current efficient water management practices, to identify and consider additional practices that may conserve water, and to document the accurate measurement of water. This RAWMP describes the Region and the participating agencies status with regard to implementation of the two in new mandatory EWMPs and includes a discussion of the potential impacts of climate change on the region's water suppliers' operations.

In order to facilitate coordination within the Planning Area, a Regional Agricultural Water Management Plan Working Group was formed. The Working Group was made up of staff from the 14 participating urban water suppliers, the San Diego County Farm Bureau and the San Diego County Water Authority. This group provided a forum for exchanging demand and local supply information and providing review and comment on Plan preparation to the consulting team.

Table 1-1 Agency Requirement to Prepare Urban Water Management Plan (UWMP)

Agency	Prepared UWMP 2010 Update	Preparing UWMP 2015 Update
Carlsbad Municipal Water District	Yes	Yes
City of Escondido	Yes	Yes
City of Oceanside	Yes	Yes
City of Poway	Yes	Yes
Fallbrook Public Utilities District	Yes	Yes
Olivenhain Municipal Water District	Yes	Yes
Rainbow Municipal Water District	Yes	Yes
Ramona Municipal Water District	Yes	Yes
Rincon del Diablo Municipal Water District	Yes	Yes
San Dieguito Water District	Yes	Yes
Santa Fe Irrigation District	Yes	Yes
Vallecitos Water District (VWD)	Yes	Yes
Valley Center Municipal Water District	Yes	Yes
Yuima Municipal Water District	Not Required	Not Required

The RAWMP is structured in two parts. Part I includes regional AWMP components, and Part II includes individual supplier AWMP components.

This document represents the third AWMP for the San Diego region and the first Regional AWMP prepared to satisfy the requirements of SBx7-7. Although the specific purpose of this RAWMP is to satisfy the SWRCB May 15, 2015 Emergency Regulation it is anticipated that many of the items covered in this RAWMP will be addressed in the updated UWMPs of the participating agencies every five years, as required in the Urban Water Management Planning Act (UWMPA). Due to this plan being completed in early 2016 prior to the approval of updated 2015 UWMPs, the 2015 UWMPs may not and are not required to address all of the items contained in the RAWMP.

1.5 Coordination Activities

At the direction of DWR staff a single entity is serving as the official agency of record for pubic noticing and RAWMP approval. Valley Center Municipal Water District (VCMWD), as the participating water supplier with the largest agricultural acreage is representing the San Diego region for public involvement purposes in the plan development and approval and serving as the agency of record for the San Diego RAWMP. VCMWD notified public entities of the AWMP preparation and adoption as shown in Table 1-1. Public participation requirements associated with preparation of an AWMP are identified in SBx7-7; however, it does not specify how much advance notice is required to cities and counties regarding plan preparation, does not require notification to any other agency(s), and does not require that comments from any city, county or other agency must be solicited and considered.

1.6 Plan Adoption and Submittal

Table 1-2 Summary of Plan Coordination, Adoption, and Submittal Activities

Interested Parties	Notified (Prep)	Assisted	Rec. Draft	Notified (Public	Notified (Adopted)	Copy of Plan
California Dept. of Water	X			X		X
City of San Marcos	X			X		X
City of Solana Beach	X			X		X
San Diego County Water	X	X		X		X
County of San Diego	X			X		X
California State Library						X
San Diego County Farm Bureau	X	X	X	X		X

SOURCES

California Department of Water Resources. 2015. A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2015 Agricultural Water Management Plan. June

2. *Regional Description & History*

Regional Planning

Draft San Diego Regional Agricultural Water Management Plan: Part I

2 Regional Description and History

2.1 Overview

The 14 retail water agencies participating in the San Diego RAWMP are all member agencies of the SDCWA. The combined service areas of the 14 agencies totals approximately 379,957 acres of which 44,209 acres comprise irrigated acreage serving commercial agricultural users. The SDCWA service area characteristics correspond to the regional characteristics of the participating agencies and are used for reference in this RAWMP in describing the region.

As noted above, the Region discussed in Part I of the RAWMP corresponds to the service area of the San Diego County Water Authority (SDCWA). SDCWA's boundaries extend from the border with Mexico in the south, to Orange and Riverside counties in the north, and from the Pacific Ocean to the foothills that terminate the coastal plain in the east. With a total of 951,000 acres (1,486 square miles), the RAWMP encompasses the western third of San Diego County. Figure 2-1 shows the Plan's study area, retail water suppliers, and regional water supply conveyance aqueducts (shown as blue lines).

Each of the Region's east-west-trending watersheds flows from elevated regions in the east toward coastal lagoons, estuaries, or bays in the west. Each of the watersheds features similar habitats at similar elevations, and all watersheds share habitat restoration and protection needs. A significant majority of the volume of surface flow in each of the watersheds is comprised of runoff from seasonal precipitation that predominantly occurs during the winter and spring months. Surface flows during summer and fall months are typically low, and consist of urban runoff, agricultural runoff, and surfacing groundwater. Each of the watersheds has similar water quality characteristics.

The county is arid and within its 4,207 square miles has just seven principal rivers, San Diego, San Luis Rey, Santa Margarita, San Dieguito, Otay, Sweetwater and Tijuana, all of which go dry in the summer. As a result, the county's residents cannot count on them for reliable year-round water and are at the end of the pipe on the state's imported water system. Although the mountains can get ample rain, their steep slopes and proximity to the coast make capturing their runoff difficult. Together, the peculiar geology and hydrology give this region the greatest variability in runoff between the wettest and driest years of anywhere in the United States. At the low end, runoff may amount to only five percent of an average year, while at the high end, it can be seven times more than the average.

One of the driest years on record was 1899-1900, when the El Capitan dam site on the San Diego River received only 980 acre-feet of runoff. The same site received 200,400 acre-feet in 1915-1916, the year of the well-known Hatfield flood that caused extensive damage throughout the county including the failure of the upper Otay Dam in the southern part of the county. This extreme variability makes storage reservoirs a necessity, yet it also makes planning their capacity and building flood-proof dams particularly challenging. Historically, the storage requirements were often underestimated; floods broke dams all too frequently. To make room for the occasional flood, most reservoirs in the county are sized so they are filled to only about 40 percent of capacity during normal years. To complicate matters, not all of the rainfall results in runoff. If the yearly average of 10 inches falls in two or three major storms, much of the water runs into streams and makes its way to reservoirs. If, however, that 10 inches falls as frequent sprinkles, which is often the case, it seeps into the ground and evaporates without producing any real runoff.

Most of the land within the region slopes to the east. Elevations range from sea level at the westerly boundary to approximately 1,400 feet at its eastern boundary. Access is obtained via Interstate 5, Interstate 15 and State Route 79 highways in the north-south direction, and Interstate 8 in the east-west direction.

Agricultural lands in the Region are found within the urbanized areas as well the suburban, exurban and more rural areas of the County. Over the last decades there has been strong pressure to convert these lands to urban uses, especially in the coastal areas where land values are extremely high. Urbanization is occurring in other areas of San Diego County that have historically been primarily agricultural resulting in the conversion of agriculture lands to large lot residential urban use. The current irrigated land area within the region is expected to continue to diminish over the long term. On a short term basis there is a minor potential for some increase in the amount of irrigated acreage in specific areas of the County due to economic advantages of increasing yields of certain crop types. The long term assumption remains a decrease in irrigated acreage due to urbanization and the increasing cost of imported supplies from the Metropolitan Water District of Southern California (MWD) and SDCWA.

2.2 History

(*Excerpted from San Diego County Water Authority (SDCWA). 2013, 2005, 2003. To Quench a Thirst; a brief history of water in the San Diego region)*

In earlier times, the county was larger. It included all of today's Imperial County, touching on the Colorado River. It extended north to encompass much of today's Riverside and San Bernardino counties. The County’s coastal plains receive an average of just 10 inches of rain a year, while the mountains receive an average of 30 inches. Yet the region seldom sees an average year. Instead, yearly precipitation tends to fluctuate greatly from year.

Early Period

Agriculture in San Diego County has been a major and at times dominant part of the local economy and way of life for almost three centuries. The Spanish introduced farming into San Diego County in 1769 with the establishment of Mission San Diego de Alcala. Farming was limited to teaching the Native Americans European agricultural practices to raise food for the Mission and for themselves. Primitive methods of irrigation were used during the long, dry summer. The first Spanish missionaries and soldiers who arrived in the area in 1769, realized the local water supply was small and erratic, and began developing water. The Spaniards constructed a dam across the San Diego River and linked the resulting reservoir with the Mission San Diego de Alcala via a six-mile aqueduct. The Old Mission Dam, which still exists in Mission Trails Regional Park, was the first water development project in San Diego County. Mission San Luis Rey de Francia was established in 1798 in northern San Diego county near today’s City of Oceanside. Limited farming was practiced at that location as well to meet Mission needs.

The Missions also introduced livestock. In 1800, they had 450 head of cattle, 1,600 sheep, 148 horses, and 14 mules. By 1828, they had a total of 58,685 head of livestock. The main products to be marketed were hides and tallow. In the early 1800's, the land owned by the Missions was taken by the Spanish Governor of Alta California and diverted into Mexican land grants, and given to individuals for ranchos involved in cattle-grazing operations. The 8,824- acre San Dieguito Rancho is now known as Rancho Santa Fe. The richest grazing ground of the San Diego Mission became the 48,799- acre El Cajon Rancho. Rancho Tia Juana covered the area from south of San Diego Bay to the Mexican border. The biggest of them all, Rancho Santa Margarita y las Flores, had 113,440 acres and extended from the coast of today's Oceanside north to Orange County and inland to Fallbrook, the current location of Marine Corps Base Camp Pendleton.

As people moved from the city to the ranchos, the population of the city of San Diego dropped from 500 in 1834 to only 150 in 1841. The larger ranchos of the Mexican era began a trend for intensifying the land use and agriculture that demanded ever more development of the meager local water resources. Local water supplies were impounded, pumped and diverted to where they were needed. Soon, ranchos claimed just about every spring and perennial stream. During this period, Southern California struggled through a severe 10-year drought, interrupted only by a flood in 1825. As pumping and diversions continued, the water table dropped and the springs dried up. Today, there are few, if any, traces left of the County’s once numerous artesian springs, most of which are so long dry that most current residents are unaware they ever existed.

The Growth of Irrigated Agriculture

In 1846, California became a territory of the United States. Production of beef became the most important industry. Water development continued to increase during the second half of the nineteenth century revolving primarily around agriculture. As early as 1853, some farmers throughout the region started making the transition from dry land farming and ranching to irrigated agriculture — and lucrative citrus crops. In 1862, 25,000 orange trees were imported from Mexico. In 1873, Brazilian naval orange trees arrived. With the prospect of large profits from citrus crops, farmers scrambled to develop local water supplies for irrigation. First, they used up their surface supplies and then they drilled ever-deeper for groundwater.

In 1853, an agricultural canal was built to divert water from the San Dieguito River system to the San Pasqual Valley near today's Escondido. The Kimball Brothers Water Company in 1869, bought rights to the Sweetwater River and then built a reservoir with a 90-foot-high dam and distribution pipes. Their water supply spurred the development of National City and Chula Vista. To the north, similar enterprises were developing. At the dawn of the 1880s, the county had a water supply company for the city and several for the backcountry. They served different constituencies: urban/domestic users and agricultural irrigators. In 1885, railway service to the city of San Diego opened the county to rapid commercial development and new markets. Production of beef cattle declined, and production of grapes, olives, and citrus expanded. Dairying and poultry raising enterprises soon followed. As the county population grew with the coming of the railroad, each constituency needed more water.

Private companies erected six major dams on local rivers between 1887 and 1897. All six stand today, providing water for residents. During this period San Diego County was one of the major focal points of dam construction in the world. Every major drainage system in the county included at least one reservoir. For example, The San Pasqual Water District built a second canal in 1887 to connect the valley to a potential dam site at Pamo Valley near Ramona (which has never been built). This developing water supply and delivery system would later spawn several dams and reservoirs that the city of San Diego would acquire in the 1920s including Lake Hodges (discussed in Part II).

To meet those growing needs, water development began in earnest. It started a transition from depending on well water to impounding river water in the mountains. With this larger-scale development in the 1890s, urban and agricultural interests began to clash. The next few decades were characterized by dueling water companies and overblown promises for water delivery, as well as the usual extreme cycles of drought and flood. The San Diego County Water Company was formed to develop Lake Henshaw in the San Luis Rey watershed. Built in 1922, Lake Henshaw supplied water to Escondido Mutual Water Company and Vista Irrigation District, with little left over for the city of San Diego. The Lake Henshaw system was acquired by the Vista Irrigation District in 1946.

In the 1920's, avocados were introduced. With the development of irrigation projects, land values, taxes, and water assessments increased the cost of farming and prompted the change from grapes and olives to avocados and citrus, which are of greater cash value. Despite some temporary shortages, this system of local reservoirs provided sufficient water for the county until World War II, when a vastly expanded military presence practically doubled the population in six years.

The Need for Imported Water

During World War II San Diego became a hub of naval activity, with military and construction workers flocking to the area as part of the unprecedented war effort. The City of San Diego's population nearly doubled in two years, to 500,000. Water use also doubled, but the rainy years before the war left the local reservoirs full. Still, it was clear that the city — and the Navy — would soon need the water from the Colorado River. The City of San Diego had been starting and stopping plans to bring Colorado River water to the region since the 1920s but had not moved forward. With the national security priority of World War II driving the urgency of obtaining additional water an aqueduct for bringing water to San Diego became a top priority.

The County Water Authority Act enabled the county to acquire water outside its boundaries and distribute it throughout the county. The San Diego County Water Authority (SDCWA) was formed in 1944 with nine member agencies. Because of the strong military presence, the federal government arranged for supplemental supplies from the Colorado River in the 1940s. In 1947, water began to be imported from the Colorado River via a single pipeline that connected to Metropolitan's Colorado River Aqueduct (CRA) located in Riverside County. To meet the water demand for a growing population and economy, the SDCWA constructed four additional pipelines between the 1950s and early 1980s that are all connected to Metropolitan's distribution system and deliver water to San Diego County. The SDCWA is now the county's predominant source of water, supplying from 75 to 95 percent of the region's needs depending upon weather conditions and yield from surface, recycled, and groundwater projects.

SDCWA joined the Metropolitan Water District in 1946 so it could receive water deliveries when the pipeline from the Colorado River Aqueduct was complete. Upon joining Metropolitan, San Diego's 112,000 acre-foot share of the Colorado River was added to Metropolitan's allotted share. On November 26, 1947, the first Colorado River water finally flowed south from the Colorado River aqueduct's western end in Riverside County for 71 miles into the city of San Diego's San Vicente Reservoir near Lakeside via the San Vicente Aqueduct (later renamed Pipeline 1 of the First San Diego Aqueduct). It ran over some of the most rugged country ever crossed by a water line and could deliver about 65,000 acre-feet per year.

In 1954, the second pipeline of the San Vicente Aqueduct, which is parallel to and the same size as the first, began delivering water. Even this doubling of capacity was insufficient. The Water Authority now had 18 member agencies and four times the service area it had when it was formed.

In 1961, a third pipeline, called Pipeline 3, was built in a second aqueduct along a different course, this one much closer to the coast. Almost three-times larger than the first pipe, it delivered an additional 170,000 acre-feet per year.

A Changing Region

By the early 1970s, the population of the SDCWA's service area exceeded 1,250,000.
In 1973, a fourth pipeline, this one capable of carrying as much water as the first three pipes combined, was added to the Second San Diego Aqueduct. It was extended to the city of San Diego's Alvarado Treatment Plant near La Mesa in 1978. By 1980, the population had grown to 1.8 million, and SDCWA now served 99 percent of the county's residents. A fifth pipeline was added to the Second Aqueduct at a point north of San Marcos in 1982. It brought the Water Authority's total pipeline capacity to about 1 million acre-feet per year, roughly 15 times more than the capacity of the first pipeline alone, which had been built only 35 years earlier.

2.3 San Diego Agriculture Today

Maintaining a Strong Agricultural Sector

The characteristics of the San Diego region have undergone significant changes over the last several decades. Driven by an average annual population increase of 50,000 people per year, large swaths of rural land were shifted to urban uses to accommodate the growth in population. This shift in land use has resulted in the region's prominent urban and suburban character. Although the total number of agricultural acres under production has declined, the region maintains a significant number of high value crops, such as cut-flowers, ornamental trees and shrubs, nursery plants, avocados, and citrus. Based on the 2014 Crop Statistics and Annual Report by the San Diego County Department of Agricultural Weights and Measures, the region has 5,732 farms, more than any other county in the United States. 68% of San Diego County farms are 1-9 acres.

San Diego County agriculture is a $1.8 billion dollar per year industry, and ranks first in the state in gross value of agricultural production for flowers, foliage, and nursery products. Statewide, San Diego County is in the top five counties for Nursery Products, Oranges, Chickens, Flowers & Foliage, Tomatoes (Fresh Market), Lemons, Avocados, Eggs (Chicken), Mushrooms, and Grapefruit. San Diego County farmers produce more than 37 commodities, that are valued in excess of $1 million dollars each. Table 2 -1 provides the economic value of San Diego commercial agriculture by major crop type.

Looking Forward

At its peak in the 1980s and again in the early 2000's agricultural water use accounted for between 15-20 % of water consumption in the region. After the drought of 2008-2011 and very large and rapid increases in wholesale water rates that amount has dropped by almost half. Agricultural use in the region accounts for 8-10% of total use and is expected to remain at that level for the next several years. Agricultural lands are projected to be reduced by almost half; the percentage of land in the County identified as agricultural in use will fall from 4% to 2%. The agricultural lands shown in Table 2-X include both irrigated agriculture and non-irrigated (cattle grazing) lands across the entire County. Most irrigated agriculture that occurs within the Region is within the Water Authority's service area. As documented within the Water Authority's 2010 Urban Water Management Plan, agricultural water demands are projected to decrease as a result of conversion of irrigated agricultural lands to residential uses.

Table 2-1 Economic Value of San Diego County Agriculture

Crop	Total Value
Ornamental Trees & Shrubs	$439,178,551
Indoor Flowering & Foliage Plants	$363,702,937
Bedding Plants, Color & Herbaceous Perennials	$228,466,067
Avocados	$154,038,303
Tomatoes	$81,878,400
Lemons	$76,660,469
Eggs, Chicken Market	$45,244,848
Cacti & Succulents	$43,400,000
Other Cut Flower Products & Bulbs	$43,320,222
Strawberries	$37,950,000

(Source: 2014 Crop Statistics and Annual Report)

Table 2-2 Existing and Projected Land Use within the County (Acres)

Land Use	Existing (2008)	2020	2035	2050	Change 2013 - 2050	
Residential	340,586	512,781	650,999	738,576	397,990	116%
Civic/Institutional	157,623	212,812	213,358	214,210	56,587	36%
Commercial/Industrial	39,449	41,446	44,496	48,198	8,749	22%
Other	123,793	131,350	131,267	131,215	7,422	6%
Parks and Open Space	1,443,074	1,390,141	1,390,981	1,392,257	(50,817)	(4%)
Agricultural	112,300	106,544	79,144	57,739	(54,561)	(49%)
Vacant Land	510,382	332,134	216,962	145,013	(365,369)	(71%)
Total	2,727,207	2,727,207	2,727,207	2,727,207	0	0%

Sources: SANDAG, 2012; Personal communication, G. Chung (SANDAG), 2013

SOURCES

San Diego County Water Authority (SDCWA). 2013, 2005, 2003. *To Quench a Thirst a brief history of water in the San Diego region*

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWM*P). June

San Diego County Regional Water Management Group (RWMG). 2013 *Integrated Regional Water Management Plan*

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3 Water Management Facilities

Regional Planning

Draft San Diego Regional Agricultural Water Management Plan: Part I

3 Water Management Facilities

3.1 Regional Facilities

Since the importation of water from the Colorado River in the late 1940's the San Diego County Water Authority (SDCWA) has constructed and operated the regional water conveyance facilities that serve the water suppliers delivering water to agricultural users in the region. This regional backbone system of pipelines, water treatment plants, surface water storage and appurtenant facilities have become increasingly integrated with the local distribution systems that deliver water to end users. In describing the region's water management facilities that convey the vast majority of agricultural irrigation water this chapter will focus on those facilities owned and operated by SDCWA. Facilities owned and operated by water suppliers with their own local surface water supplies that are conveyed to treatment plants and then to end users will be addressed in Part II of the RAWMP.

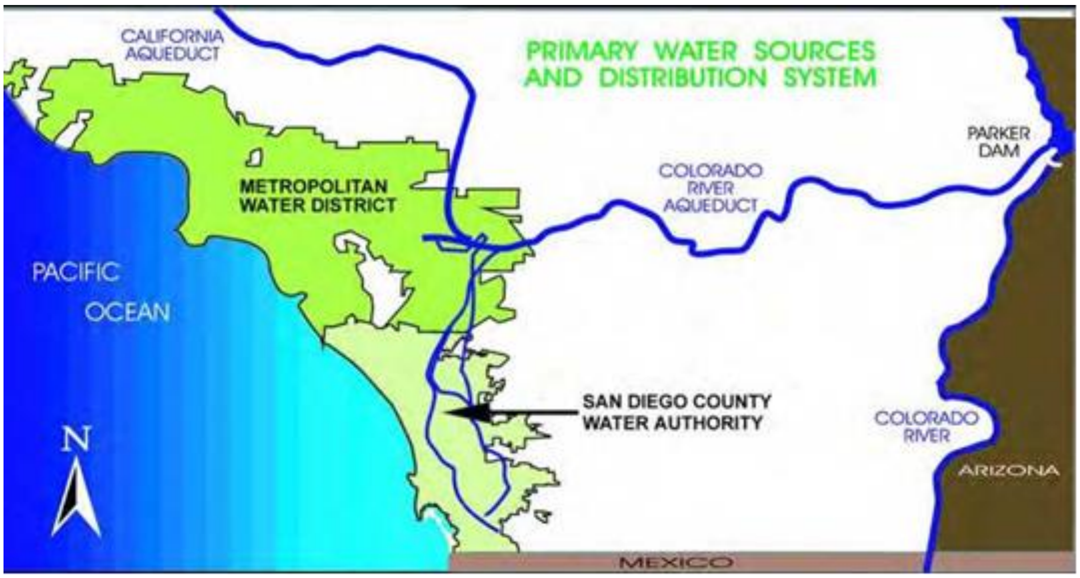
3.1.1 Water Conveyance

Water diversion and conveyance infrastructure in the region tends to be relatively similar in nature, although there are some notable differences between the water suppliers that have their own local surface water supplies and those dependent on imported water from the Water Authority. Most water delivered to suppliers from the SDCWA and local water owned by retail water agencies is almost exclusively via gravity flow with no pumping required. Depending upon operational considerations, the SDCWA may deliver water from local reservoirs it owns or has storage rights in to local agencies that use pumps to lift water from the reservoir for conveyance to their distribution system via gravity. Within water supplier distribution systems, water diverted is conveyed via gravity, although depending on service area topography, suppliers lift water using pumps to deliver to higher elevation portions of their service areas.

The 24 retail water agencies (SDCWA member agencies) in the region purchase water from the SDCWA for distribution within their service territories. A 36-member Board of Directors (Board) comprised of member agency representatives governs the SDCWA. The member agencies' six cities, five water districts, eight municipal water districts, three irrigation districts, a public utility district, and a federal military reservation have diverse and varying water needs. Imported water supplies are delivered to the SDCWA member agencies through a system of large-diameter pipelines, pumping stations, and reservoirs. The pipelines deliver supplies from the Metropolitan Water District of Southern

California (MWD) are divided into two aqueduct alignments, both of which originate at Lake Skinner in southern Riverside County and run in a north to south direction through the SDCWA service area.

Figure 3-1 Imported Water Distribution



Metropolitan's ownership of these pipelines extends to a "delivery point" six miles into San Diego County. From there, Pipelines 1 and 2 comprise the First San Diego Aqueduct, which reaches from the delivery point to the San Vicente Reservoir. These two pipelines share five common tunnels and operate as a single unit to provide 180 cubic feet per second (cfs) of conveyance capacity. Pipelines 3, 4, and 5 form the Second San Diego Aqueduct. These pipelines, which are located several miles to the west of the First San Diego Aqueduct, have delivery point capacities as follows: Pipeline 3 provides 280 cfs; Pipeline 4 provides 470 cfs; and Pipeline 5 provides 500 cfs.

Table 3-1 SDCWA Pipelines

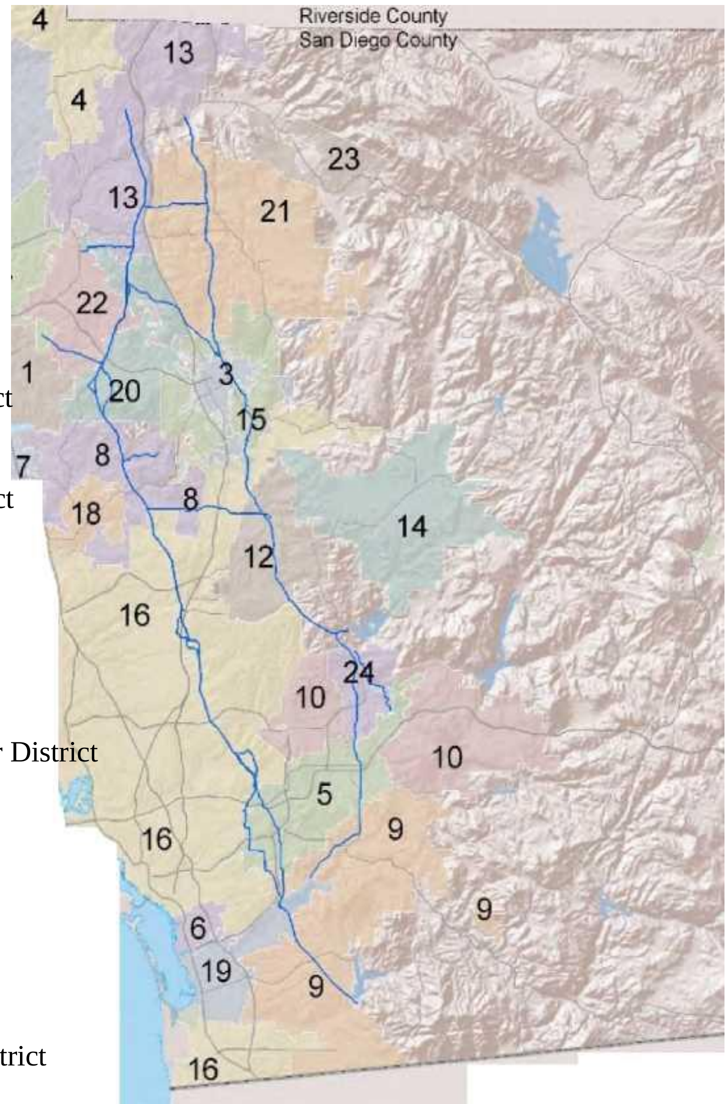
Pipelines	Length (miles)	Diameter (in)
FIRST SAN DIEGO AQUEDUCT:		
Pipeline 1 and Pipeline 2	64.4	48-72
La Mesa-Sweetwater Extension	16.4	18-42
Moreno-Lakeside Pipeline	4.5	54-60
SECOND SAN DIEGO AQUEDUCT:		
Pipeline 3	57.0	66-75
Pipeline 4	75.0	69-108
Pipeline 5	33.3	96-108
Crossover Pipeline	7.5	66
North County Distribution Pipeline	4.5	72
Tri-Agencies Branch Pipeline	6.4	21-42
Ramona Pipeline	7.2	36-57
Valley Center Pipeline	4.5	66
Olivenhain Pipeline	4.5	78
Olivenhain-Hodges Pipeline	1.5	120

In addition to the above north-south pipelines, there are several east- west pipelines that extend service to multiple member agencies. A listing of the pipelines owned and operated by the SDCWA is provided in Table 3-1, with the pipeline locations shown in Figure 3-2. Although most of the water conveyed through the aqueduct system is by gravity flow, the SDCWA also maintains several pumping stations that enhance the operational flexibility of the pipeline system to meet daily, seasonal, and emergency needs.

Three of the water pump stations are for untreated water and are sized to protect the region from potential disruptions of imported water supplies. If a supply disruption occurs, the untreated water pump stations will deliver emergency water supplies from newly expanded or existing local storage reservoirs At other times, except for the Miramar Pump Station, all the SDCWA-owned pumping stations can be used to move water supplies into and out of storage reservoirs to meet seasonal delivery needs and to augment daily supplies to the member agencies. The Miramar Pump Station is mainly used to deliver treated water via the aqueduct system from the city's Miramar Water Treatment Plant to City of San Diego service connections south of the treatment plant.

Figure 3-2 SDCWA Regional Conveyance and Member Agency Location

1 Carlsbad Municipal Water District
2 City of Del Mar
3 City of Escondido
4 Fallbrook Public Utility District
5 Helix Water District
6 City of National City
7 City of Oceanside
8 Olivenhain Municipal Water District
9 Otay Water District
10 Padre Dam Municipal Water District
11 Camp Pendleton MCB
12 City of Poway '
13 Rainbow Municipal Water District
14 Ramona Municipal Water District
15 Rincon del Diablo Municipal Water District
16 City of San Diego
17 San Dieguito Water District
18 Santa Fe Irrigation District
19 South Bay Irrigation District
20 Vallecitos Water District
21 Valley Center Municipal Water District
22 Vista Irrigation District
23 Yuima Municipal Water District
24 Lakeside Water District



3.1.2 Water Storage

Storage facilities are used by the SDCWA to both manage daily operations and provide reserves for seasonal, drought, and emergency storage needs. System Regulatory Storage facilities, which consist of enclosed reinforced concrete storage tanks, are available to manage the daily balance of treated and untreated water deliveries. System Regulatory Storage within the aqueduct system currently totals 56 million gallons, with the bulk of this amount in storage tanks located in Twin Oaks Valley and the Mission Trail Regional Park.

The SDCWA has invested heavily in the past decade in developing regional carryover and emergency storage capacity to provide increased reliability during droughts and improve the access to supply during emergencies. This includes construction of the Olivenhain Reservoir, which is part of the region’s Emergency Storage Project (ESP). The ESP will add a combined total of 90,100 AF of storage capacity and is designed to protect the region from disruptions in the water delivery system. The ESP consists of construction of the 24,000 AF capacity Olivenhain Reservoir, connection of the 30,000 AF Lake Hodges to the regional aqueduct system and the raising of the existing San Vicente Dam to provide 52,000 AF of storage capacity for SDCWA. In addition, SDCWA augmented the ESP with a carryover storage component at of 100,000 AF at San Vicente. Construction of the San Vicente Dam Raise was completed in 2015 and as of December 2015, SDCWA has approximately 70,000 AF of in-region carryover storage in San Vicente Reservoir. Total Water Authority in-region storage is shown in Table 3-2.

Figure 3-3 Key Reservoirs in San Diego County

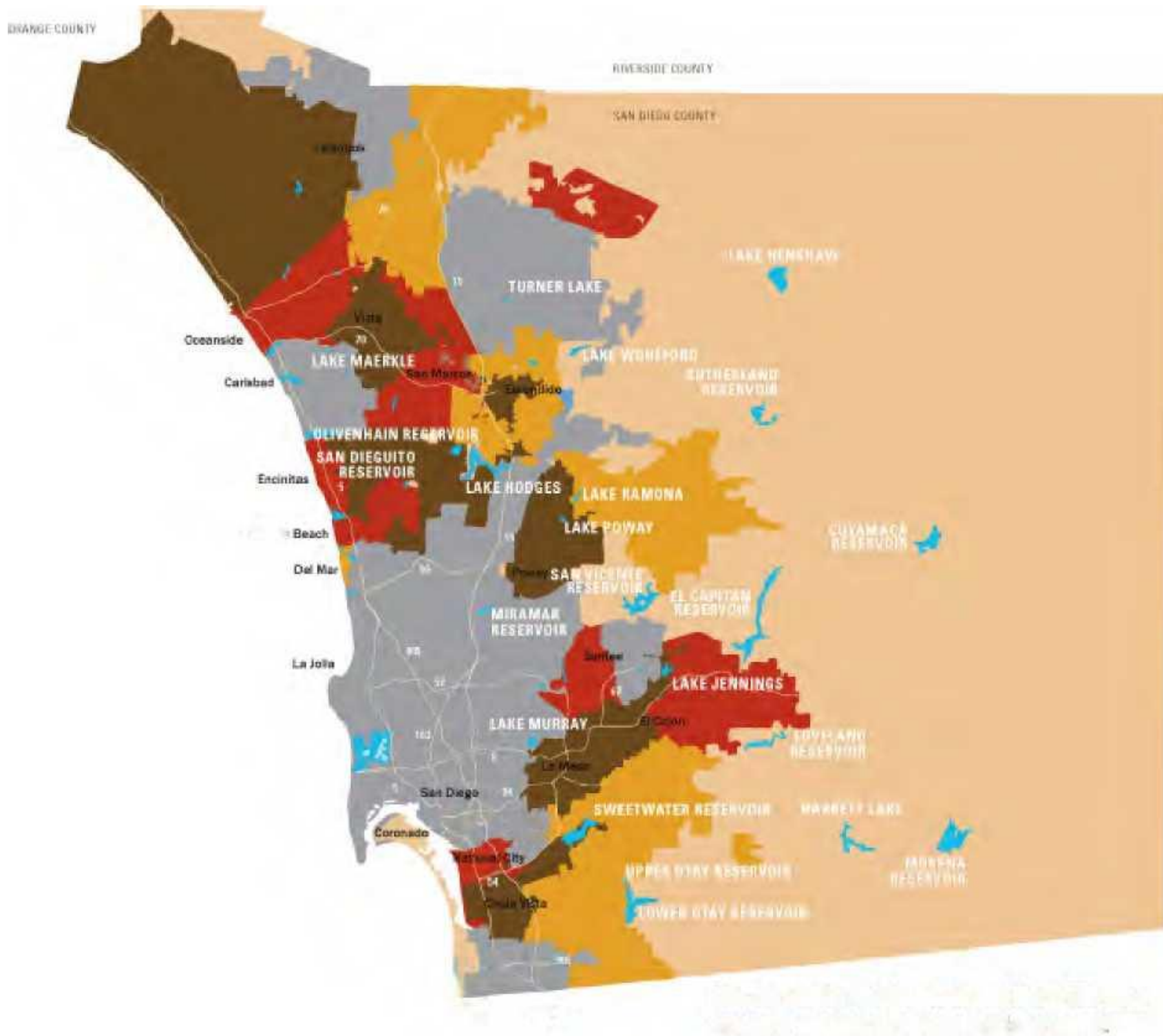


Table 3-2 Water Authority In-Region Storage Pools

Reservoir	Storage Capacity(AF)	Pool Type
Hodges	20,000	Emergency Pool
San Vicente	52,000	Emergency Pool
San Vicente	100,00	Carryover Pool
Olivenhain	24,364	Emergency Pool
Total	**196,364**	

3.1.3 Water Treatment

Up until 2008, the SDCWA purchased its treated water supplies from Metropolitan and from member agencies that own and operate local water treatment plants. As ***early as 2001, the supplies from*** Metropolitan were being constrained by increasing treated water demands on the Metropolitan system and insufficient treated water pipeline conveyance capacity. As a result, in June 2004, the SDCWA began construction of the 100 million gallons per day (MGD) Twin Oaks Valley Water Treatment Plant (WTP). This WTP was completed and placed in service in April 2008, and now produces high-quality drinking water serving mainly northern San Diego County.

In addition to the Twin Oaks Valley WTP, the SDCWA entered into an agreement with the Helix Water District to purchase 36 MGD of treatment capacity from the R.M. Levy WTP. Water from the Levy plant supplements treated water service to eastern San Diego County. The balance of treated water supplies comes from local retail agency owned and operated water treatment plants. A list of all in-region water treatment plants is shown in Table 3-3.

Table 3-3 In-Region Treatment Plant Capacity

Treatment Plant Owner/ Operator	Water Treatment Plant Capacity (MGD)	
Escondido, city of/Vista Irrigation District	Escondido/Vista	65
Helix Water District	Levy	106
Olivenhain Municipal Water District	Olivenhain	34
Oceanside, city of	Weese	25
Poway, city of	Berglund	24
Ramona Municipal Water District	Bargar	4
San Diego, city of	Alvarado	120
San Diego, city of	Miramar	140
San Diego, city of	Lower Otay	40
San Diego County Water Authority	Twin Oaks Valley	100
San Dieguito Water District/Santa Fe Irrigation	Badger	40
Sweetwater Authority	Perdue	30

3.1.4 Hydroelectric Generation

The SDCWA has long supported efforts to develop renewable energy resources that are compatible with water operations. The SDCWA's inline conduit hydroelectric facilities at Alvarado, Miramar, and Rancho Penasquitos are able to generate electricity from the available elevation gradient in the aqueduct system to produce an environmentally friendly, clean, and sustainable energy supply. These facilities also generate additional revenues that help offset the cost of imported water supplies. The Alvarado and Miramar facilities are currently out of service but will be evaluated for re-operation under the 2012 Regional Water Facilities Optimization and Master Plan Update. The Rancho Penasquitos facility has been in continuous operation since 2006 and typically generates enough power to meet the needs of nearly 5,000 county households. The SDCWA's Olivenhain-Hodges facility will provide the region with 40 megawatts (MW) of energy storage, making this power supply available to meet peak demands during high energy use periods. A listing of the SDCWA's hydroelectric facilities is presented in Table 3-4.

Table 3-4 SDCWA Hydroelectric Facilities

Hydroelectric Facilities	Rated Output (MW)
Alvarado (currently out of service)	2.0
Miramar (currently out of service)	0.8
Rancho Penasquitos	4.5
Olivenhain-Hodges Pumped Storage	40.0
Total Rated Output	**47.3**

3.2 Drainage Facilities

Because of the small size of farms in the region and the extensive use of buried pipelines in a highly urbanized region there are no lined or unlined canals, drains, tailwater or spill recovery devices. The San Diego region has a complex storm drainage system composed of streets and gutters, catch basins, underground pipes, ditches, pump stations, and channels. This predominant use in the region is used to carry flood water away from homes and businesses into rivers and streams. During rain events or wet conditions, storm water and urban runoff is typically collected via drains from impervious surfaces; such as buildings, rooftops, paved driveways, and improved streets, to be conveyed downstream through the storm water system. When runoff cannot infiltrate into the ground, precipitation will follow drainage patterns, typically to the lowest point, collecting contaminants, sediment or debris along the way. Storm water and urban runoff can also erode unstable soil, carrying sediment that could be conveyed downstream. Typically, urban runoff from development sources, such as irrigated landscaped areas, is the surface water collected during dry weather that also flows through the storm water system. Urban runoff results from human activities rather than the natural hydrological cycle.

Storm water facilities include, but are not limited to, a network of underground storm drain pipes, culverts, outfalls/inlets, detention basins, and open flood control channels. Open storm water facilities may protect downstream water quality by filtering pollutants via accumulated sediment and vegetation that may naturally be deposited because of the site’s topography or configuration of the channel or basin. In such cases, flood control facilities can also support natural resources, such as wetlands, or provide linkages to other habitats for wildlife.

The County of San Diego and the local municipalities are responsible for maintaining the system. Water agencies that are special districts typically do not maintain drainage facilities, Capture of storm water as water supply is limited to existing surface water impoundments in the higher elevations of the county. In the past there have been tail water return systems and impoundments of water for use in some of the larger groves in the County. That type of water management is believed to be more limited as evidenced by the predominance of small size farms. On farm management of drainage water is primarily focused on avoiding pollution related impacts to in-region water bodies.
Extensive regulations adopted by the San Diego Regional Water Quality Control Board (SDRWQCB) require all agricultural and nursery operations in the San Diego region to sample and test wet and dry weather runoff for pollutants and report the findings. The regulations allow for two options: 1) Conduct the testing and reporting as a group or 2) act individually to submit plans and testing results directly to the SDRWQCB.

The San Diego County Farm Bureau (SDCFB) provides members with the collective testing and reporting option through the San Diego Region Irrigated Lands Group (SDRILG).

3.3 Flood Control and Management

Although precipitation in the Region is highly variable, flooding remains a high risk in many communities. Flooding in the Region occurs during periods of heavy rainfall, particularly after long dry spells.

The Floodplain Management Plan for the County of San Diego (FEMA, 2007) reports that from 1770 until 1952, 29 floods were recorded in the County of San Diego. Between 1950 and 2006, flooding prompted 12 Proclaimed States of Emergency in the County of San Diego. Several very large floods have caused significant damage in the County. The Hatfield Flood of 1916 destroyed the Sweetwater and Lower Otay Dams, and caused 22 deaths and $4.5 million in damages. The most recent serious floods affecting the County occurred during tropical storms Kathleen (1977) and Doreen (1978) and during winter storms in 1980, 1987, 1993, 1998, and 2005. In the 1980 flood, approximately 16-20 inches of rain accumulated over a six-week period. This slow moving storm, which was the most severe since the Hatfield Flood of 1916, lead to wide-spread small stream flooding and evacuations of residents in Mission Valley. The San Diego River at Mission Valley peaked at 27,000 CFS and caused $120 million in damage (FEMA, 2007). Flooding during the 2004-2005 wet season caused $7.7 million in damages, and flash flooding since 1993 has caused upwards of $16 billion in damages, countywide (San Diego County, 2011a).

Within the Region there are two categories of flooding: precipitation-induced and non-¬precipitation-induced. Precipitation-induced flooding includes flash floods, debris flows, and alluvial fan floods. The central and eastern portions of San Diego County are most susceptible to flash floods where mountain canyons, dry creek beds, and high deserts are the prevailing terrain (FEMA, 2007). Additional risks from precipitation induced flooding stems from the association of wildfires with flooding. As fires remove vegetation, runoff is not taken up by vegetation and soils are destabilized. This leads to an increase in runoff entering streams, increasing flooding risks, and to an increase in debris flow risks. Because the Region is prone to wildfires, and this risk is expected to increase as an impact of climate change, the risk of flooding that is exacerbated by wildfires needs to be managed.

An additional flood risk that can be exacerbated by wildfires is non-native invasive vegetation species. Land that has been cleared by wildfire is more susceptible to regrowth of non-native invasive vegetation species. Invasive species, such as giant reed (Arundo donax), can outcompete native species and dominate riparian areas. Once established, Arundo in particular can change diverse native riparian areas into monotypic non-native riparian areas. Arundo provides very little habitat value to native wildlife and dead and dry stands can become a fire hazard themselves. The root system of Arundo along with its typical dense growth structure can cause increased sedimentation and narrowing of channels. This can increase flood risk on adjacent lands.

Non-precipitation-induced flooding is caused by urbanization, landform modification, faulty drainage facilities, dam failures, tsunamis, and seiches (standing waves in an enclosed or partially enclosed body of water). Of these, the Region is most at risk from flooding caused by urbanization and faulty drainage facilities. Urbanization increases impervious surfaces, and therefore increases runoff. This runoff enters streams more quickly, in higher volumes, and at greater speeds. Each of these contributes to an increase in flood risk if the channels or streams are not able to accommodate the increased runoff. These problems can be made worse by faulty drainage facilities, which may fail or overflow if not adequately sized or maintained (San Diego County, 2011a).

Federal Emergency Management Agency (FEMA) flood zones represent the areas susceptible to the 1% annual chance flood (often referred to as the "100-year flood"), and the 0.2% annual chance flood ("500-year flood"). The 1% annual chance flood, also known as the "base flood," has at least a 1% chance of occurring in any given year. FEMA designates this area as the Special Flood Hazard Area (SFHA) and requires flood insurance for properties in this area as a condition of a mortgage backed by federal funds. Designated high-risk areas are those within the 100-year floodplain, while areas within the 500-year floodplain are considered low-risk. Areas within the Region at highest risk for flooding are typically downstream areas along rivers, and concentrated around the coast at bays, coastal inlets, and estuaries. Properties that are included in the SFHA may be contested, and those interested in changing a property's floodplain designation may submit a request for a Letter of Map Change ***(***LOMC) to FEMA. If FEMA approves a LOMC, the FEMA Flood Insurance Rate Map will be officially revised or amended by FEMA; such an amendment will likely reduce insurance requirements and can reduce development restrictions.

Within the Region, over 101,000 people are exposed to high-risk from flooding. The potential losses due to damages to buildings in high-risk areas are over $17 billion, with $2.2 billion of critical facilities (e.g. hospitals, infrastructure) at high-risk from flooding (San Diego County, 2010).

In order to address these risks, a Multi-Hazard Mitigation Plan was developed for San Diego County (San Diego County, 2010). This Mitigation Plan included participation from the SDCWA, California Emergency Management Agency, FEMA, local and regional officials, the Rancho Santa Fe Fire Protection District, and stakeholder input. The Mitigation Plan includes specific goals, objectives, and actions for each jurisdiction to help address or mitigate the identified risks. Common actions related to mitigation of flood risks include maintaining current flood maps, discouraging growth in flood-risk areas, improving or maintaining stormwater systems, incorporation of natural flood control measures into design and development, continue to monitor and assess drainage, and develop comprehensive flood management and response plans.

SOURCES

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWMP*). June

San Diego County Regional Water Management Group (RWMG). *Integrated Regional Water Management Plan (2013)*

San Diego County Water Authority (SDCWA). 2014. *2013 Regional Water Facilities Optimization Study and Master Plan.*

4. Terrain & Soils

Regional Planning

4 Terrain and Soils

4.1 Overview

The San Diego region is highly varied geographically, encompassing sub-regions of coastline, coastal plain, terraces, narrow valleys, foothills and mountains. The elevations of the area range from sea level to 4,300 feet. Agriculturally important soils consist mostly of well- drained course, sandy loams in the sloped areas and deep, sandy loams in river bottom areas. Clay pans underlie some bottom areas, complicating irrigation management due to salinity and poor drainage. Only 6 percent of the land is considered prime farmland. The foothills and steep slopes characteristic of much of the region are unsuitable for urban development but provide the excellent drainage of both water and air needed to grow avocados. Micro-irrigation, the predominant form of irrigation locally, is an effective and efficient way to apply water in groves growing on steep, erodible slopes. Should avocados cease to be profitable in these areas, it is uncertain that the steep slopes could be developed for any other use.

The soil types in San Diego County vary in structure, texture, and chemistry with geographical location. The coastal plain has undergone several episodes of marine inundation and subsequent marine regression throughout the last 54 million years, resulting in deposition of a thick sequence of marine and non-marine sedimentary rocks on the uplifted and eroded high relief basement terrain. Gradual emergence of the region from the sea occurred in Pleistocene time, and numerous wave-cut platforms, most of which were covered by relatively thin marine and non-marine terrace deposits, formed as the sea receded from the land. Accelerated stream erosion during periods of heavy rainfall, coupled with the lowering of the base sea level during Quaternary times, resulted in rolling hills, mesas, and deeply incised canyons which characterize the landforms presently occurring in the much of the region.

The Peninsular Ranges were subject to regional uplift and erosion throughout the Tertiary Period. Continued erosion and down cutting of drainage courses through the Quaternary Period have resulted in the present topography. In general, trends of several of the major drainage courses that have developed appear to be controlled by ancient fractures or major joint systems within the crystalline bedrock. Drainages are underlain by thin to moderate thicknesses of sandy stream-deposited alluvium. A weathering profile of variable thickness has developed upon bedrock that underlies the valley floors throughout the Plan Area. The ongoing weathering process has created a layer of residuum (decomposed granite), which typically consists of moderately to highly decomposed rock material that grades erratically downward to unweathered bedrock material.

The San Diego Area has been divided into four major physiographic provinces; the Desert, the Mountains, the Foothills, and the Coastal Plains. These provinces reflect differences in climate, soils, and land use. To generally describe soils types, soils are divided into associations (USDA 1973). The San Diego region has been divided into 34 soil associations, each with variable susceptibility to erosive forces, depending on their individual characteristics. The 34 soil associations in the San Diego Area have been assigned to 8 groups. The grouping is based on soil characteristics and qualities and on location of the associations in the specified physiographic province.

4.2 Soil Groups

A comprehensive soil survey conducted in 1973 by the Soil Conservation Service, the University of California and other federal agencies provides the most definitive cataloging of soil types in San Diego County. Soils were divided into 8 groups and are classified as follows:

Group I. Excessively Drained to Well-Drained, Nearly Level to Moderately Sloping Very Gravelly Sands to Silt Loams on Alluvial Fans in Desert Areas

The soils in this group are excessively drained to well-drained very gravelly sands, loamy coarse sands, sandy loams, and silt loams. They formed in material derived from acid igneous rock and mica schist. Slopes range from 0 to 9 percent. The elevation ranges from 100 to 2,500 feet. The average annual rainfall is between 3 and 8 inches, and the average annual air temperature be-tween 70° and 74° F. The frost-free season is 240 to 275 days. The vegetation consists of desert shrubs, cactus, and scattered annual grasses and forbs.

Group II. Excessively Drained to Well-Drained, Gently Sloping to Strongly Sloping Loamy Coarse Sands to Sandy Loams on Alluvial Fans and in Basins in Mountainous Areas

The soils in this group are excessively drained to well-drained loamy coarse sands, coarse sandy loams, and sandy loams. They formed in material derived from granitic rock. Slopes range from 2 to 15 percent. The elevation ranges from 2,500 to 4,500 feet. The average annual precipitation is between 11 and 22 inches, and the average annual air temperature between 56° and 59° F. The frost-free season is 150 to 200 days. The vegetation consists of annual grasses and forbs, shrubs, and scattered California oaks. These soils are used mainly for range. A limited acreage is used for dry farmed hay and grain.

Group III. Excessively Drained to Moderately Well Drained, Nearly Level to Moderately Sloping Loamy Sands to Clays on Alluvial Fans and Alluvial Plains in Foothill and Coastal Plain Areas

The soils in this group are excessively drained to moderately well drained sands, loamy sands, sandy loams, gravelly sandy loams, clay loams, and clays. They formed in material derived from marine sandstone and shale and granitic rock. Slopes range from 0 to 9 percent. The elevation ranges from near sea level to 2,000 feet. The average annual rainfall is between 10 to 18 inches, and the average annual air temperature between 60° and 62° F.

Group IV. Somewhat Excessively Drained to Moderately Well Drained, Nearly Level to Steep Loamy Coarse Sands to Clay Loams on Terraces in Foothill and Coastal Plain Areas

The soils in this group are somewhat excessively drained to moderately well drained loamy coarse sands to gravelly clay loams that have a loamy coarse sand to clay subsoil. In some areas these soils are underlain by a hardpan. They formed in alluvium derived from a variety of rocks. Slopes are generally between 2 and 15 percent but range from 0 to 50 percent. The elevation ranges from near sea level to 1,800 feet. The average annual rainfall is between 10 and 18 inches, and the average annual air temperature between 60° and 62° F. The frost-free season is 260 to 350 days. The vegetation consists of annual grasses and forbs, shrubs, and a few scattered oaks. The irrigated agricultural uses are found predominantly within this Group. The soils on the Coastal Plains are used for irrigated citrus, truck crops, flowers, and avocados, and those in the Foothills for irrigated citrus and pasture. Undeveloped areas are used for range. Urban use is increasing.

Group V. Excessively Drained to Well-Drained, Moderately Sloping to Very Steep Loamy Coarse Sands to Loams on Uplands in Mountainous Areas

The soils in this group are excessively drained to well-drained loamy coarse sands to loams. They formed in material derived from mica schist, gabbro, granodiorite, and quartz diorite. Slopes range from

5 to 75 percent. In many areas these soils are eroded. In most areas rock outcrops or stones cover 2 to 10 percent of the surface. The elevation ranges mainly from 2,000 to 6,000 feet. Some peaks rise above 6,000 feet. The average annual precipitation is between 12 and 38 inches, and the average annual air temperature between 53° and 58° F. The frost-free season is 135 to 230 days. The vegetation consists mainly of coniferous woodland or chaparral and an understory of annual grasses and forbs. These soils are used for range, wildlife habitat, and watershed. Some small areas are used for apple and pear orchards. Others are used as recreational areas and cabin sites.

Group VI. Excessively Drained to Moderately Well Drained, Gently Sloping to Very Steep Sandy Loams to Silt Loams on Uplands in Foothill Areas

The soils in this group are excessively drained to moderately well drained sandy loams to silt loams that have a coarse sandy loam to clay subsoil. They are derived from granitic rock, gabbro, tonalite, metavolcanic rock, and metasedimentary rock. Rock outcrops or stones cover up to 10 percent of the surface in many areas. Slopes range from 2 to 75 percent. The elevation ranges from 200 to 3,500 feet. The average annual rainfall is between 12 and 20 inches, and the average annual air temperature between 59° and 64° F. The frost-free season is 240 to 340 days. The vegetation consists chiefly of a chaparral-type cover and an understory of annual grasses and shrubs. An oak-savannah type cover grows on the gentler slopes. Scattered oaks and other tree species grow along drainage ways and in areas where water collects. These soils are used for citrus, irrigated field crops, avocados, range, wildlife habitat, watershed, and recreational areas. Urban use continues to increase in some areas. Seven associations of the San Diego Area are in this group. They make up 30 percent of the Area.

Group VII. Well Drained and Moderately Well Drained, Moderately Sloping to Very Steep Loamy Fine Sands to Clays on Uplands in Coastal Plain Areas

The soils in this group are well drained and moderately well drained loamy fine sands to clays. They formed in material derived from marine sandstone and shale and breccia. In some places the soils that have a surface layer of loamy fine sand and loam have a sandy clay and clay subsoil. Slopes range from 5 to 75 percent.

The elevation ranges from near sea level to 1,800 feet. The average annual rainfall is between 10 and 16 inches, and the average annual air temperature between 60° and 62° F. The frost-free season is 280 to 350 days. The vegetation consists of annual grasses and forbs and scattered shrubs. Shrubs are predominant in areas of shallow or eroded soils. These soils are used for truck crops, citrus, dry farmed grain, range, watershed, and wildlife habitat. Urban and industrial uses are increasing.

Group VIII. Miscellaneous Land Types of the Desert, Mountains, Foothills, and Coastal Plains

The miscellaneous land types in this group vary considerably in soil characteristics and qualities. They are used only for wildlife habitat, watershed, and recreational areas.

4.3 Characteristics Typical of Region's Irrigated Agriculture

Soils in the steeply sloped areas where most agricultural uses are located is generally shallow, coarse, with sandy loams ideal for avocado culture. In the bottomlands, soils are sandy loams that may be underlain by clay pans that greatly complicate irrigation management and drainage problems. Steep slopes of coarse, sandy loam are well suited for avocados that have fastidious requirements for good drainage. Good drainage reduces fungal root diseases and the buildup of salts that occurs with water high in total dissolved solids such as water imported from the Colorado River. Micro-irrigation can be very efficient and lends itself well to irrigating crops on steep slopes.

In further classifying soils, an association normally consists of one or more major soils and at least one minor soil, and is named for the major soils. Soils in an association typically differ in slope, depth, stoniness, drainage, and other characteristics that affect management. Soils in the RAWMP planning area generally consist of well - drained, medium -to coarse -grained, often rocky sandy loams, commonly with clay loam substrata and underlying igneous and metamorphic bedrock. Most of the soils within the Plan Area have severe erodibility limitations.

For the portion of San Diego County that includes the Participating Agencies agricultural users, the Plan Area contains eleven general soil associations as indicated by the San Diego County Soil Survey (1996). Soils associations are useful for developing a general idea of the soils in an area and for determining the value of an area for certain uses. The following outlines these soil classifications.

- **Marina-Chesterton Association*:*** This association consists of somewhat excessively drained to moderately well drained loamy coarse sands and fine sandy loams that have a subsoil of sandy clay over a hardpan. This soil type is located between sea level and 400 feet above mean sea level and occurs on grades of 2 to 15 percent (NRCS 1973).

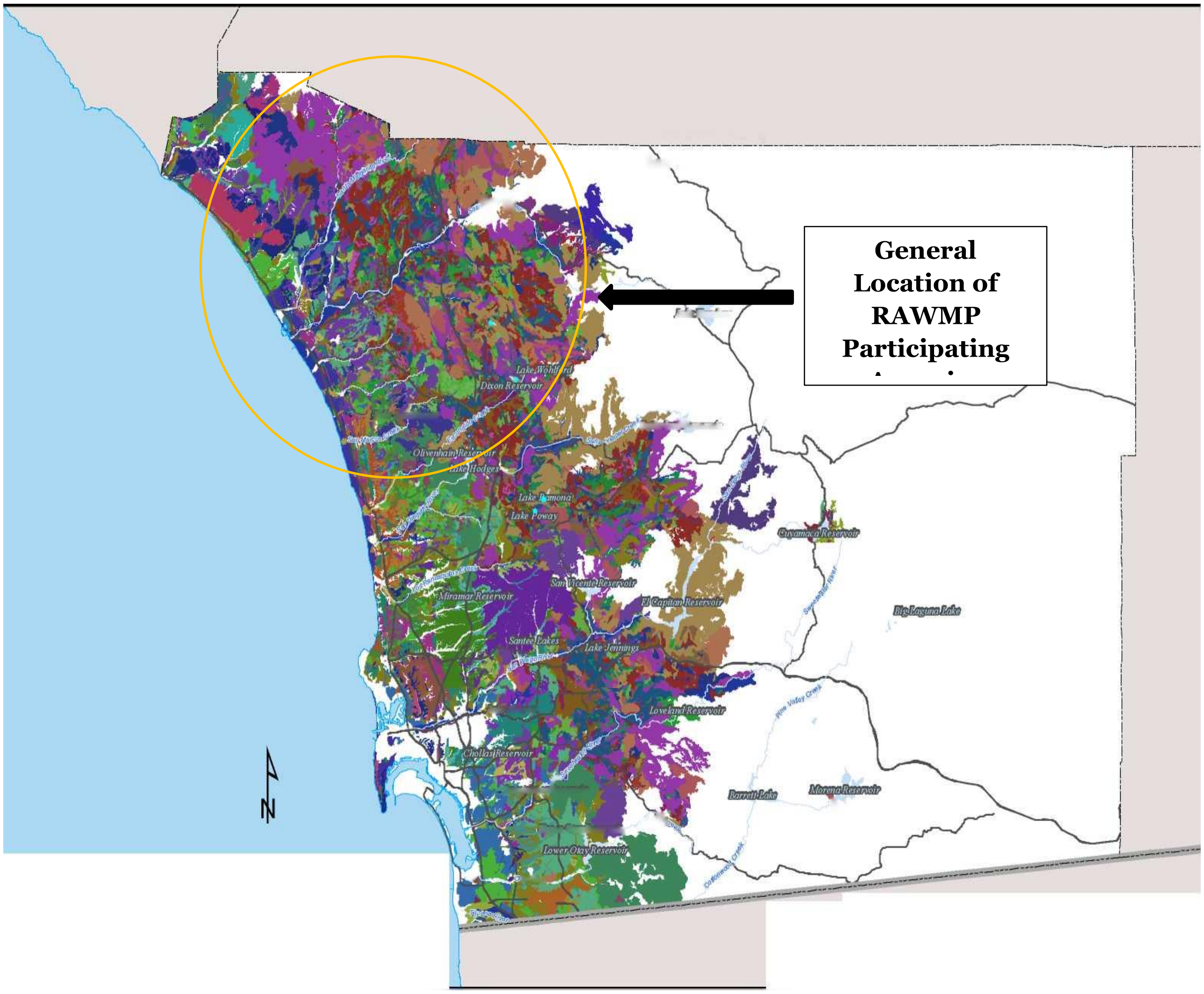
- **Salinas-Corralitos Association:** This consists of moderately well-drained to somewhat excessively drained clays, clay loams, and loamy sands on alluvial fans, on 0 to 9 percent slopes.
- **Cieneba-Fallbrook Association (Very Rocky):** These soils are excessively drained to well-drained coarse sandy loams and sandy loams that have a sandy clay loam subsoil over decomposed granodiorite. These soils occur between 200 and 3,000 feet above mean sea level and occur on 9 to 75 percent slopes.
- **Exchequer-San Miguel Association:** Rocky, well drained silt loams over metavolcanic rock, typically on 0 to 30 percent slopes.
- **Diablo-Altamont Association:** Well drained clays are the major characteristic of this association, normally found on 5 to 15 percent slopes.
- **Diablo-Las Flores Association:** This association consists of well drained clays and moderately well drained loamy fine sands that have a subsoil of sandy clay. These soils occur between 100 and 600 feet above mean sea level and occur on 9 to 30 percent slopes (NRCS 1973).
- **Las Flores-Huerhuero Association:** This association consists of moderately well drained loamy fine sands to loams that have a subsoil of sandy clay or clay; 9 to 30 percent slopes.
- **Ramona-Placentia Association:** This association consists of well drained and moderately well drained sandy loams to sandy clay over granitic alluvium. This soil type is largely in foothills between 200 and 1,800 feet above mean sea level and occurs on grades of 2 to 15 percent.
- **Fallbrook-Bonsall Association:** These soils are well drained and moderately well drained sandy loams that have a subsoil of sandy clay loam and clay loam over decomposed granodiorite in areas with 2 to 9 percent slopes. This association is made up of soils that developed in material weathered in place from granitic rock. It occurs on uplands and in swales in the Foothills. The elevation ranges from 200 to 2,500 feet.
- **Fallbrook-Vista Association (Rocky):** These soils consist of well-drained sandy loams and coarse sandy loams that have a subsoil of sandy clay loam and sandy loam over decomposed

granodiorite. These soils occur between 200 and 2,500 feet above mean sea level and occur on 9 to 30 percent slopes.

- **Friant-Escondido Association (Eroded):** These soils are excessively well drained fine sandy loams and very fine sandy loams over metasedimentary rock. These soils occur between 400 and 3,500 feet above mean sea level and occur on 30 to 70 percent slopes (NRCS 1973)

The generalized soils map units or soil associations underlying the area, shown in Figure 4-1, are described in the soil surveys for San Diego County, prepared by the U.S. Natural Resources Conservation Service. The general locations of the participating agencies are identified within the circled area.

Figure 4-1 Generalized Soil Map of San Diego County



Legend for Soils Map

Sources

Soil Conservation Service and Forest Service 1973, *Soil Survey San Diego Area*, California

San Diego County 2011, *General Plan Update Final Environmental Impact Report* (FEIR)

San Diego County Water Authority, Valley Center Municipal Water District, Mission Resource Conservation District 2001, *Agricultural Water Management Plan*

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5. Climate

Regional Planning

Draft San Diego Regional Agricultural Water Management Plan: Part I

5 Climate

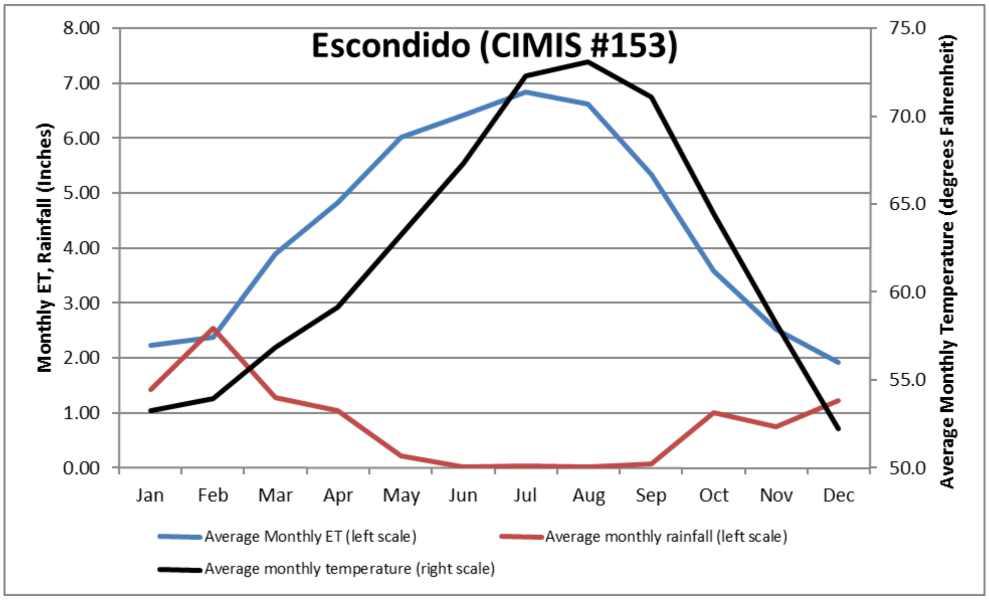
5.1 Regional Precipitation and Temperature

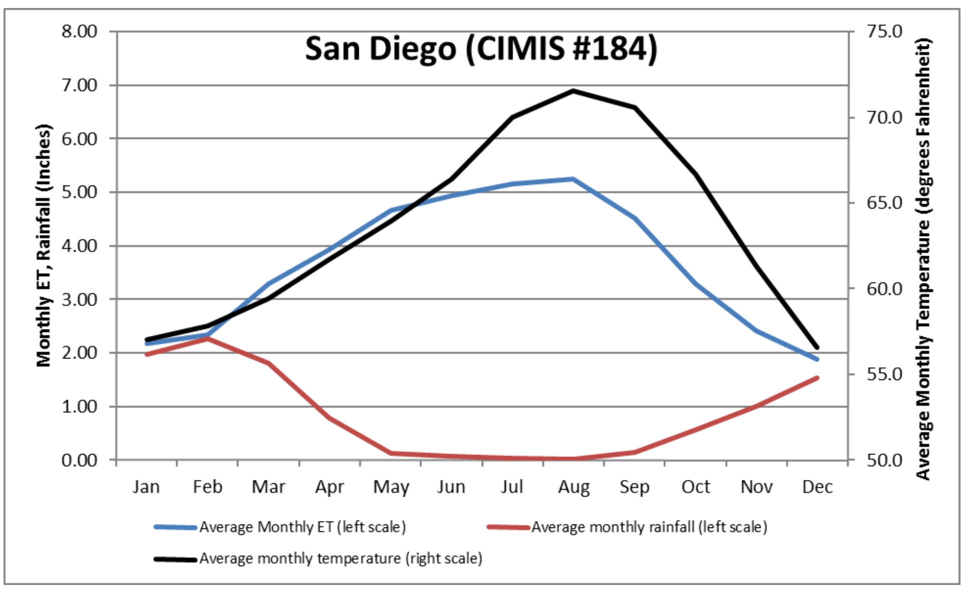
The Region experiences a Mediterranean climate characterized by mild temperatures year-round at the coast. Inland area weather patterns are more extreme, with summer temperatures often exceeding 90 degrees Fahrenheit and winter temperatures occasionally dipping below freezing. Inland areas are both hotter in summer and colder in winter, with summer temperatures often exceeding 90 degrees and winter temperatures occasionally dipping to below freezing. In Figures 8-1 and 8-2, Information from California Irrigation Management Information System (CIMIS) station # 184 in coastal San Diego shows an average monthly temperature of 72 degrees in August and an average monthly temperature of 56 degrees in December. CIMIS station # 153, in Escondido in inland San Diego County shows an average monthly temperature of 74 degrees in August and a monthly average temperature of 52 degrees in December. CIMIS information from those two stations also indicate that there is almost no precipitation between May and October and ET in those areas tracks accordingly.

Mild weather with many micro climates and a long growing season enables farmers to grow crops that may not be grown anywhere else in the United States or during times of the year when certain vegetables, fruits, flowers or exotic items may not be available from any other areas. The region is not entirely frost-free, but frost is less of a problem than in other mild weather areas in the United States. Mild weather gives local growers a distinct competitive edge over other parts of the country.

Average annual rainfall is approximately 10 inches per year on the coast, and in excess of 33 inches per year in the inland mountains. More than 80% of the region's rainfall occurs between December and March. Figure 8-X presents the geographic distribution of mean annual precipitation within San Diego County, demonstrating that annual precipitation in the region follows a pattern of increased precipitation with increased elevation. With the exception of the cultivated areas along the coastal strip of Oceanside-Carlsbad -Encinitas, the Escondido CIMIS station weather is more representative of the region’s inland irrigated agricultural areas.

Figure 5-1 Comparison of San Diego and Escondido CIMIS Stations





Significant variation in precipitation also occurs from year to year. Table 5-1 summarizes annual precipitation for a 75-year period at San Diego Lindbergh Field and a 97-year period at the City of

Escondido precipitation stations. Annual precipitation totals range from more than double the annual mean to less than half the annual mean.

Average precipitation across San Diego County is highly variable (Figure 8-X). The western coastal and foothills region of the County averages between 6 to 18 inches per year, with increasing amounts in the foothills. The central mountainous region averages between 15 to 35 inches per year. This higher rainfall is attributable to the orographic effect created by the higher elevations of the mountains, which raises and cools the moist marine air as it moves inland from the ocean over the mountains. The highest precipitation in the County occurs on Palomar Mountain (elevation 6,140 ft msl) and Cuyamaca Peak (elevation 6,512 ft msl), with precipitation in the wettest years exceeding 70 inches.

Table 5-1 Annual Rainfall Deviation from Mean

		San Diego (Lindbergh Field)		**Escondido (Composite)**	
		Inches	**% of Mean**	**Inches**	**% of Mean**
Exceedance	Maximum	24.93	251%	33.83	228%
	5%	17.74	179%	25.71	173%
	10%	16.05	162%	23.68	159%
	25%	11.76	118%	18.56	125%
	50%	8.74	88%	13.13	88%
	75%	6.64	67%	10.61	71%
	90%	4.61	46%	7.07	48%
	95%	3.83	39%	5.83	39%
	Minimum	3.41	34%	4.32	29%
	Mean	9.93	-	14.85	-

5.1.1 El Niño/La Niña Effects on Precipitation

Weather patterns throughout the world have been linked to cycles of warmer- or cooler-than-average surface water temperatures in the equatorial Pacific Ocean from between South America and the dateline. Warmer than average equatorial surface water temperatures are known as "El Niño", and cooler than average surface water temperatures are known as "La Niña." Historically, El Niño and La Niña conditions recur approximately once every 3 to 7 years and vary in both intensity and duration. During El Niño conditions, the period of October through March generally tends to be wetter than average in southern California. In contrast to El Niño, La Niña conditions bring generally dryer-than-average winters to southern California (NOAA, 1998). It should be noted that not all El Niño periods have brought above-average rainfall, and not all La Niña periods have brought below-average rainfall. However, since El Niño/La Niña cannot be accurately predicted beyond several months into the future, it is difficult to predict an upcoming year's precipitation with a high level of confidence. In addition, precipitation does not always follow the typical El Niño/La Niña patterns. As scientific research continues to expand regarding this phenomenon, it may be possible to predict future precipitation for an upcoming season with greater confidence.

5.2 Evapotranspiration

The term "evapotranspiration" refers to the total transfer of moisture to the atmosphere from the soil, water bodies, vegetative canopy, and plants. Evapotranspiration represents a significant portion of water lost from a given watershed. Types of vegetation and land use significantly affect evapotranspiration and therefore, the amount of water leaving a watershed. Factors that affect evapotranspiration include the plant type (root structure and depth), the plant's growth or level of maturity, percentage of soil cover, solar radiation, humidity, temperature, and wind. Monthly reference evapotranspiration (ETo), which is a measure of potential evapotranspiration from a known surface, such as irrigated grass or alfalfa has been estimated for San Diego County by CIMIS (Figure 8-X). As would be expected, the lowest ETo rates are typically during the cooler and wet winter months and highest during the summer. The lowest annual ETo rates in the County occur along the coastal region due to the marine influence with high humidity and moderate temperatures year round. In contrast, the highest annual ETo rates occur in the desert region due to the extremely dry air and very hot summers. Since irrigation water requirement is driven by the weather, using the CIMIS weather stations is a strategy that the region's growers utilize to estimate the previous week's actual water use and refine their going forward practices. Seven CIMIS stations in the region assist agricultural and urban irrigators in irrigation scheduling.

Table 5-2 Reference Evapotranspiration (ETo) Table by CIMIS Zone

Reference Evapotranspiration													
	Monthly ETo (inches)												**Total**
CIMIS Zone	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
1	0.93	1.4	2.48	3.3	4.03	4.5	4.65	4.03	3.3	2.48	1.2	0.62	32.92
4	1.86	2.24	3.41	4.5	5.27	5.7	5.89	5.58	4.5	3.41	2.4	1.86	46.62
6	1.86	2.24	3.41	4.8	5.58	6.3	6.51	6.2	4.8	3.72	2.4	1.86	49.68
9	2.17	2.8	4.03	5.1	5.89	6.6	7.44	6.82	5.7	4.03	2.7	1.86	55.14
16	1.55	2.52	4.03	5.7	7.75	8.7	9.3	8.37	6.3	4.34	2.4	1.55	62.51
18	2.48	3.36	5.27	6.9	8.68	9.6	9.61	8.68	6.9	4.96	3	2.17	71.61

CIMIS - California Irrigation Management Information System

ETo - Reference Evapotranspiration

Table 5-3 San Diego County Reference Evapotranspiration (ETo) Table

		Annual ETo	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coastal	Torrey	46.4	1.8	2.2	3.4	4.5	5.3	5.7	5.9	5.6	4.5	3.4	2.4	1.8
	Oceanside	48.7	2.1	2.4	3.7	4.8	5.4	5.7	6.0	6.0	4.6	3.6	2.4	2.0
	Chula	44.2	2.2	2.7	3.4	3.8	4.9	4.7	5.5	4.9	4.5	3.4	2.4	2.0
Coastal	San Diego	46.5	2.1	2.4	3.4	4.6	5.1	5.3	5.7	5.6	4.3	3.6	2.4	2.0
	Miramar	46.4	1.8	2.2	3.4	4.5	5.3	5.7	5.9	5.6	4.5	3.4	2.4	1.8
Inland	Otay Lake	50.5	1.3	1.9	3.3	4.7	5.9	7.0	7.8	6.8	5.2	3.5	2.0	1.2
	Santee*	51.1	2.1	2.7	3.7	4.5	5.5	6.1	6.6	6.2	5.4	3.8	2.6	2.0
	Ramona	51.6	2.1	2.1	3.4	4.6	5.2	6.3	6.7	6.8	5.3	4.1	2.8	2.1
Mountain	Escondido	57.0	2.5	2.7	3.9	5.3	6.1	6.9	7.3	7.0	5.5	4.2	3.0	2.5
	Pine Valley*	54.8	1.5	2.4	3.8	5.1	6.0	7.0	7.8	7.3	6.0	4.0	2.2	1.7
	Warner	56.0	1.6	2.7	3.7	4.7	5.7	7.6	8.3	7.7	6.3	4.0	2.5	1.3
Desert	Borrego Springs	75.4	2.7	3.5	5.9	7.7	9.7	10.1	9.3	8.3	6.9	5.5	3.4	2.2

Climate change and its potential impacts on water resources in the region are described in Section 11.

SOURCES

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWM*P). June

San Diego County Regional Water Management Group (RWMG). *Integrated Regional Water Management Plan (2013)*

County of San Diego DPLU (02/10), *Water Efficient Landscape Design Manual*

San Diego County Water Authority (SDCWA), Valley Center Municipal Water District (VCMWD), Mission Resource Conservation District (MRCD) 2001, *Agricultural Water Management Plan*

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6. Operational Characteristics

Regional Planning

Draft San Diego Regional Agricultural Water Management Plan: Part I

6 Operational Characteristics

6.1 Operating Rules and Regulations

6.1.1 Rules and Regulations Affecting Water Availability

Each agricultural water supplier within the region possesses its own operating rules and regulations and associated policies. These protocols are described in greater detail for the Participating Water Suppliers in Part II of this RAWMP.

In general, operating rules and regulations of the participating water suppliers include policies on water allocation, water usage, required fees and charges, timing of water deliveries, and water transfers into or out of each supplier's service area. The operating rules and regulations vary to some extent based on the organization of individual suppliers. For example, water districts formed under Chapter 11 of the CWC have policies and procedures that are determined by a board of directors who require the districts to hold a certain amount of money in reserve, but mutual water companies operating in the service area of one of the participating agencies have policies and procedures that are determined by a board of trustees. Charter and General Law cities both deliver to commercial agricultural users and are governed by mayors and city council governing structures.

The SDCWA is the primary source of surface water in the region. The SDCWA's enabling legislation, the *County Water Authority Act*, and SDCWA's Administrative Code set the requirements for delivery and in cases of shortage, how supplies will be allocated to its 24 member agencies. The SDCWA does not have contracts with its member agencies but through its enabling legislation has a duty to serve. As stated in the County Water Authority Act

> "The *board of directors, as far as practicable, shall provide each of its member agencies with adequate supplies of water to meet their expanding and increasing needs. If available supplies become inadequate to fully meet the needs of its member agencies, the board shall adopt reasonable rules, regulations, and restrictions so that the available supplies are allocated among its member agencies for the greatest public interest and benefit".*

In its turn the SDCWA does not have a contract with MWD its largest wholesale supplier, which has a similar obligation to serve its member agencies through its enabling legislation, the *Metropolitan Water District Act*.

For those supplies that are not provided by MWD, SDCWA has individual contractual agreements that contain specific terms and conditions for timing, quantities, transportation, water quality and price. The agreements for the purchased of conserved Colorado River supplies are between SDCWA and the Imperial Irrigation District (IID). There are several agreements related to conserved water from the All-American and Coachella Canal linings. Both these sources of Colorado River water are part of the more encompassing *Quantification Settlement Agreement* (QSA) and California's 4.4 Plan for living within its allocation 4.4 MAF of Colorado River water. These agreements and supplies are also subject to compliance with federal and state environmental permits that allow for the diversion of conserved agricultural water from IID and the All-American and Coachella Canal linings to San Diego. The SDCWA-MWD Exchange Agreement sets the terms and conditions for the transportation of conserved agricultural water from the Colorado River to San Diego County. A Water Purchase Agreement between the SDCWA and Poseidon Resources sets the terms and conditions on price, quality, water quality and operating requirements for the production and delivery of desalinated seawater to SDCWA's regional water conveyance system.

Local water supplies that are owned by the retail water agencies are governed by their individual agency rules and regulations. In general, surface water diversions rely on historic water rights and permits obtained by those water agencies. There are also agreements between agencies that govern inter-agency rights and use of local surface water and storage rights in local reservoirs. The details of those rights will be discussed for the individual water supplier in Part II of this RAWMP. In terms of agreements pertaining to regional water supplies, SDCWA has agreements with the City of San Diego and OMWD for joint use of certain reservoirs for emergency and carryover storage. These agreements also require the development of Reservoir Regulatory Plans that set the rules for reservoir operation and management.

Imported water is always the supplemental source of supply for retail water suppliers in the San Diego region and in many instances their only source. For those agencies that experience reduced local surface water supplies during extended dry periods reliance on SDCWA supplies increase. It is only when constraints on available imported water supplies occur (MWD supplies) that a shortage at the retail level occurs. In the event of a water shortage and reduced water availability, there is not a proportional decrease in irrigated acreage. A common response by commercial growers in areas of the region with tree crops is the "stumping" of a proportion of a grove that results in reduced water use as required under the shortage contingency plan discussed in Part I Section 7.

An example of this practice occurred in the previous drought of 2008-2011. Growers were required to reduce water usage at first by 15% and then in 2009-2011 by 30% under MWD's Interim Agricultural Water Program (IAWP), discussed in greater detail below. In response, one-third of producing trees were stumped in the service areas of several agricultural water suppliers. Although an immediate water savings is realized through this practice it is difficult to sustain for an extended drought event as the trees require more than minimal watering after 1-2 years. If required to stump additional acreage to continue to achieve water savings during a very prolonged shortage the grower may not be able to economically recover. This pattern was experienced during the last drought where customers turned off their meters and abandoned their orchards. This was a significant contributor to the substantial reduction in irrigated acreage of avocado production in northern San Diego County.

A typical pattern with agricultural users using private groundwater wells is to see reduced production from private pumping due to extended dry conditions. In these cases, growers will supplement reduced groundwater supplies with imported water, to the extent possible. In water shortage years, groundwater well production has historically decreased. This results in even more increased pressure on already stressed and limited imported supplies. When allocation of regional water supplies is implemented by SDCWA, agricultural customers are required by their individual agencies to reduce water use. The most recent shortages where supplies have been allocated by SDCWA have occurred in 2014-2015 and in 2009-2011 when SWP contractor allocations were significantly reduced to historic lows. Similar shortage allocations and patterns of response occurred in the prolonged drought of 1987-1992. The rules and policies that govern the regional response to shortages is described in detail in Section 6.

6.1.2 Water Delivery Measurements

Water measurement is practiced throughout the region. All water suppliers measure deliveries for water accounting and to efficiently and effectively manage available water supplies. Thirteen of the fourteen participating water suppliers in RAWMP are signatories to the MOU for *Urban Water Conservation in California* and have complied with the BMPs regarding water metering and leak detection and repair.

For purposes of water measurement, agricultural and Municipal & Industrial customers are treated similarly.

Wholesale Supplier Measurements

Article 5 of SDCWA's Administrative Code sets the rules and requirements for regional water service. All water delivered by SDCWA to the retail water agencies is metered at the point of connection. Member agencies place daily water orders from SDCWA for either treated or untreated water and are entitled to two (2) scheduled flow changes during a 24-hour period. SDCWA operations staff coordinates with MWD operators to place water orders for either treated or untreated water. All deliveries by MWD to SDCWA is metered at all points of connection.

The SDCWA maintains flow measurement devices, either differential pressure type Venturi meters or Positive Displacement meters, that measure the quantity of water delivered through each of the turnouts from the SDCWA Aqueduct. Meters are required to be tested by SDCWA at its expense at intervals of not less than one year and any member agency may have the meter through which it is served tested by the SDCWA at any time at its own expense. In the event that a test discloses an error exceeding plus or minus two percent, an adjustment is made in charges against the agency affected.

SDCWA reconciles monthly deliveries to its member agencies turnouts with deliveries from MWD owned pipelines to SDCWA turnouts. Two of the participating water suppliers receive delivery directly from MWD owned meters and those quantities are also reconciled each month. SDCWA provides monthly estimated water bills to each of its member agencies to reconcile with their own information on water deliveries. Annually, the retail agencies and SDCWA are able to reconcile deliveries to individual agency turnouts with monthly deliveries to retail customer meters. This allows for very accurate water accounting between the wholesale and retail levels and identification of water losses.

Retail Supplier Measurements

Water measurement within retail supplier service areas typically occurs at the customer connection point. All end user delivery locations are equipped with flowmeters that indicate instantaneous flow and accumulate the quantity delivered with a totalizer. The most common metering is Positive Displacement Meters which are found in most connections under 2" in diameter. Some agencies employ velocity type meters, either single jet or multi jet, for some of their larger diameter connections. As a rule, all retail deliveries to agricultural customers by water suppliers in the region are metered and read on a regularly scheduled basis either manually or increasingly through Automatic Meter Reading (AMR). Meter reads are taken either monthly or bi-monthly for all agencies in the Plan area. All of the retail water suppliers participating in the RAWMP provide water service on-demand to all of their customers. Those water suppliers with large agricultural water demand maintain communication between the distribution system operators and the large agricultural customers to manage peak demand periods s and plan for operational efficiencies.

Because of the annual reconciliation process described above, the close coordination between SDCWA and the retail water agencies and SDCWA Administrative Code requirements to ensure meters are properly calibrated there is a high level of confidence the wholesale water meters provide a very accurate method of measuring both the flow rate and the volume of water delivered into the retail agency turnouts. The region's retail water agencies existing water measurement devices perform very accurately and all reflect compliance with AWWA standards for accuracy. Staff at all retail agencies routinely monitor meters for abnormalities and a meter is replaced if the abnormal reading cannot be corrected in the field. In addition to agency staff monitoring for any abnormal performance, property owners in any of the retail agencies can request the meter be tested.

6.2 Water Pricing

Water pricing structures are subject to complying with state law and adhering to cost of service principles. Pricing can be used to influence water usage, address issues or concerns, and promote water management objectives as long as the structures comply with cost of service principles.

Wholesale Pricing

Existing water supplier pricing structures within the region are influenced by several factors with the most significant being water pricing from the two wholesale supply agencies, SDCWA and MWD. Typically, wholesale supply prices and the cost of water treatment can make up 65-70% of the retail water bill. SDCWA's supply costs from MWD, IID conserved canal lining water and the Carlsbad Desalination Project are melded into a per acre foot cost of delivered supply. Per acre foot charges are also applied for water delivered to agencies requiring treatment and for all deliveries, treated and untreated, for the cost of transporting the water. Additional fixed charges are calculated annually and allocated to each member agency for the cost related to administrative and customer service and the cost of recovering primarily debt service on the capital cost of adding and connecting approximately

200,000 acre feet of new water storage capacity over the last 15 years In this last year the SDCWA added a Water Supply Reliability Charge to cover a portion the fixed cost of the Carlsbad Desalination Project and the Canal Lining projects that enhanced water reliability for the region. . In addition to these SDCWA fixed charges MWD fixed charges are passed on to the retail water agencies and paid annually. All of these fixed charges and wholesale commodity related charges are then passed through by the retail water agencies to their customers.

SDCWA has an agricultural water pricing program that establishes a *Transitional Special Agricultural Water Rate* (TSAWR) for qualifying customers. Commercial agricultural customers with 1 acre or more are eligible for a special class of service rate. Qualified users pay the pass through cost of MWD supplies and do not pay the fixed charge for storage facilities described above. The discount for CY 2015 was $182/AF and for CY 2016 is $186/AF. In return, in the event of a supply shortage of MWD water these agricultural customers receive cutbacks equivalent to the MWD supply cuts to SDCWA. They do not benefit from the lower supply cuts M&I rate payers experience as they benefit from the more reliable SDCWA Colorado River and seawater desalination supplies. TSAWR customers also receive a lower level of service in an emergency from the Emergency Storage Project (ESP) and are cut at twice the rate of M&I customers. In a drought shortage they also would not benefit from supplies stored in SDCWA's Carryover Storage pool. This lower level of reliability is in exchange for a discount in the cost they pay for water.

Not all agricultural users participate in the TSAWR. Many of the high value nursery growers, cut flowers and a sizable portion of smaller avocado growers want the enhanced and more certain reliability offered by SDCWA's other supplies. These commercial growers pay full price for water supply and are treated in an equivalent manner with M&I during drought and emergency shortages. The number of commercial agricultural users that pay full price for water to avoid the higher potential cutbacks that TSAWR customers face has continued to grow since the previous drought ended in 2011. Table 6-1 displays wholesale water rates charged to the retail agencies for delivered water to agricultural users for TSAWR and non-TSAWR classes of service. The wholesale rates are factored into the retail agencies costs recovered through their rates and charges applied to agricultural users.

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Table 6-1 SDCWA Wholesale Water Rates

Class of Service	CY 2015 $/AF	CY 2016 $/AF
Full Service Treated	$1,365	$1,439
Full Service Untreated	$1,087	$1,159
TSAWR Treated	$1,183	$1,253
TSAWR Untreated	$905	$1,067

Retail Agency Pricing

The remaining local agency factors that are reflected in pricing include operating costs, typical demands based on M&I sector expected use, irrigated acreage, cropping and irrigation methods, and historical precedent. Water suppliers typically establish rates to recover administrative, O&M, and long-term capital improvement costs. Pricing structures also include a fixed monthly service charge to cover an agency's fixed costs and reduce volatility of volumetric charges regardless of water usage. Because not all commercial agricultural customers purchase water at published agricultural water rates the following reflect the types of additional charges:

- *Commodity Charge:* based on per acre foot, Hundred Cubic Feet or 1,000 gallons. This charge applies directly to the measured volume of water delivered and is used for all crops.
- *Pumping Charges:* These charges are volumetric based on water delivered and pumping elevation
- *SDCWA Infrastructure Charges:* These are charges that reflect payments made by the retail agency to SDCWA for regional water infrastructure

Water pricing structures and water rates corresponding to the participating water suppliers are described in greater detail in Part II of this regional AWMP. Although not contemplated in assessing compliance with CCR 23 §597, all of the participating water suppliers have a pricing structure based in large part on the volume of water delivered to individual customer meters.

Sources

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWM*P). June

San Diego County Water Authority (SDCWA). 2015. *Administrative Code*

Water Research Foundation. 2011 *Accuracy of In-Service Meters at High and Low Flow Rates*

7. Regional Water Shortage Allocation Policies

Regional Planning

Draft San Diego Regional Agricultural Water Management Plan: Part I

7 Regional Water Shortage Allocation Policies

7.1 Overview

In the last 25 years the San Diego region has been through three major state wide droughts that resulted in imported water shortages and retail level cutbacks to Agricultural and Municipal and Industrial (M&I) customers. San Diego County's shared experience has proven that cooperation and coordination between the regional wholesaler, SDCWA, and the retail water suppliers provides the strongest basis for effectively managing a drought and is in the best interests of the residents and businesses that the region's water agencies serve.

The current four-year drought and its resulting water supply shortages combined with the challenges of complying with the State Water Resources Control Board (SWRCB) Emergency Water Conservation Regulation has once again shown the value and necessity of regional cooperation in San Diego County. The region's coordinated approach to drought management and water shortages has resulted in reductions in excess of the SWRCB aggregate conservation target for San Diego County water agencies and has led the way for a strong response to conservation from the public.

This Section will describe the regional policies that guide drought management and shortage allocation that are also adopted by local agricultural water suppliers through the region's coordinated approach. Part II of this RAWMP will describe the individual retail water supplier policies that implement that regional approach.

7.2 Water Shortage and Drought Response Plan

Water Shortages in the region are triggered by reductions in the availability of imported water and by cutbacks by MWD to SDCWA. Even those agencies with local surface and groundwater supplies that are affected by hydrologic variance do not institute cutbacks at the retail level until imported water is curtailed by SDCWA. For purposes of Part I of the RAWMP the shortage polices of SDCWA will be discussed as the regional approach to drought management and water shortage contingency planning. Part II will provide reference to individual supplier actions which as noted above are very much aligned with the regional approach. Of prime importance, is that the region desires to act during a shortage in a coordinated manner and drought response actions at the local level seek to be consistent with the regional approach of SDCWA for purposes of effective and clear communications with the public.

Following the major drought in California of 1987 - 1992, which led to severe water supply shortages throughout the state, the SDCWA and its member agencies aggressively developed plans to minimize the impact of potential shortages. In 2006, the SDCWA Board of Directors adopted the Water Shortage and Drought Response Plan (WSDRP), to serve as a comprehensive plan in the event that the region faced supply shortages due to drought or other water shortage conditions.

The WSDRP was developed by the SDCWA in coordination with its member agencies to provide a balanced, flexible, systematic approach to identifying regional actions necessary to reduce the impacts from shortages.

It includes all aspects of drought planning, from steps to avoid rationing, to drought response stages, water shortage allocation methodology, pricing, tracking actual reductions in water use, and a communication strategy. Multiple actions are identified to manage shortage situations, including both supply augmentation measures and demand reductions up to 50 percent in water supply. Conservation savings is an essential component of meeting the need for water in a time when available supplies are limited.

The WSDRP is organized into three stages: voluntary supply management, supply enhancement, and mandatory cutbacks including a supply allocation methodology. These stages are summarized in the Drought Response Matrix in Table 7-1.

7.3 Drought Response Matrix

The WSDRP includes a drought response matrix that serves as guidance to the SDCWA and member agencies in selecting potential regional actions to lessen the severity of shortage conditions. As shown in Table 7-1, the matrix identifies the three drought stages and potential actions available to the SDCWA at each stage.

Table 7-1 Drought Response Matrix

STAGES			
Potential SDCWA Drought Actions	**Voluntary**	**Supply Enhancement**	**Mandatory Cutbacks**
Ongoing BMP implementation	X	X	X
Communication strategy	X	X	X
Monitoring supply conditions and storage levels	X	X	X
Call for voluntary conservation	X	X	X
Draw from SDCWA carryover storage	X	X	X
Secure transfer option contracts	X	X	X
Buy phase 1 spot transfers (cost at or below Tier 2		X	X
Call transfer options		X	X
Buy phase 2 spot transfers (cost at or above Tier 2		X	X
Implement allocation methodology			X
Utilize ESP Supplies			X

7.3.1 M&I Supply Allocation Methodology

In the event of mandatory supply cutbacks from MWD, the WSDRP includes an M&I allocation methodology to determine how the SDCWA's available supplies will be equitably allocated to its member agencies. The allocation methodology applies to those customers paying the M&I rate, including residential, commercial, and industrial customers as well as non-SAWR agricultural customers. Agricultural users that are not participating in the reduced price SAWR program are treated as M&I users during a shortage allocation when establishing a member agency's supply allocation from SDCWA. During an allocation, the actual reduction in retail agency deliveries is determined through monthly meter reads, which are compared to the allocation targets for each member agency. This tracking information is then provided in monthly progress reports to the SDCWA board of directors.

The SDCWA administers the M&I allocation methodology following the procedures and policies contained in the SDCWA's Resolution Establishing Procedures and Policies for Administration of the Drought Management Plan Water Supply Allocation Methodology. The resolution includes a requirement for the SDCWA staff to report monthly to the Board of Directors and member agency managers on how agency deliveries are tracking compared to their allocation target.

7.3.2 Agricultural Supply Allocation Methodology (TSAWR)

In the event of a mandatory cutback by MWD, SDCWA has a separate agricultural supply allocation policy for participants in the Transitional Special Agricultural Water Rate (TSAWR). As described in Section 6.2, TSAWR customers pay a reduced price for water in recognition of their receiving a reduced level of service during a drought or emergency shortage. Similar to the M&I allocation, TSAWR agricultural customers are allocated water following the procedures and policies contained in the SDCWA's Resolution *Establishing Procedures and Policies for Administration of the Drought Management Plan and Water Supply Allocation Methodology*. Also similar to M&I water use, the resolution includes a requirement for the SDCWA staff to report monthly to the Board of Directors and member agency managers on how agency TSAWR deliveries are tracking compared to their allocation target.

Under the shortage allocation policy TSAWR customers are allocated water based on a base year of historical water use. For purposes of the current drought, per SDCWA Board policy TSAWR customers historic base period is FY 2014. TSAWR customers are cutback at the MWD cutback rate to SDCWA. SDCWA's Colorado River transfers and desalinated seawater as well as the use of SDCWA carryover storage supplies are not used in determining SAWR customer's allocation of available regional supplies. In the current drought, TSAWR program supply allocations are based on a MWD cutback level of 15 percent. When SDCWA's other more reliable supplies are factored into the M&I allocation it results in an approximately 1% cutback in FY 2016 to agricultural customers paying the full basic M&I water rate. Establishing a cutback based on the allocation of available supplies was superseded by the SWRCB Emergency Regulation and the individual conservation targets established under the Regulation.

Despite the exemption for commercial agriculture provided in the SWRCB's Emergency Regulation, customers under the SAWR program are required under Program rules to reduce water usage by the MWD cutback level of 15%. How individual retail water suppliers manage their agricultural customers' allocation of water under SAWR is describe in Part II of this RAWMP.

7.3.3 Model Drought Response Conservation Ordinance

In March 2008, the Water Authority's Board of Directors approved for release a *Model Drought Response Conservation Program Ordinance* (Model Drought Ordinance) for use by member agencies in updating their existing ordinances. The Model Drought Ordinance was developed with input from the member agencies to provide regional consistency during periods of shortages. The Department of Water Resource's 2008 Updated Urban Drought Guidebook was also utilized as a reference document for preparation of the Model Drought Ordinance. It identifies four drought response levels that contain water-use restrictions to help achieve demand reduction during temporary shortages. The restrictions become more stringent at each successive level to obtain necessary savings and delay economic impact until higher levels. Table 10-2 shows the correlation between the WSDRP stages and the Model Drought Ordinance.

The Model Drought Ordinance was used by the member agencies in updating their individual

Table 7-2 Correlation Between WSDRP Stages and Model Ordinance Levels

WSDRP Stage	Drought Response Level	Use Restrictions	Conservation Target
1	1 - Drought Watch	Voluntary	Up to 10%
1	1 - Drought Watch	Voluntary	Up to 10%
2	1 - Drought Watch	Voluntary	Up to 10%
	2 - Drought Alert	Mandatory	Up to 20%
3	2 - Drought Alert	Mandatory	Up to 20%
	3 - Drought Critical	Mandatory	Up to 40%
	4 - Drought Emergency	Mandatory	Above 40%+
2	1 - Drought Watch	Voluntary	Up to 10%
	2 - Drought Alert	Mandatory	Up to 20%
3		Mandatory	Up to 20%
	3 - Drought Critical	Mandatory	Up to 40%
	4 - Drought Emergency	Mandatory	Above 40%+

ordinances to help promote regional consistency. Member agencies independently adopt retail-level actions to manage potential shortages (described in Part II of this RAWMP). Since its approval, all of the member agencies have updated their existing ordinances, based on the Model Drought Ordinance, but also tailoring their individual ordinances to their unique service area and characteristics. Similar to the Model Drought Ordinance, the member agencies' ordinances provide specific mandatory restrictions on water use during a water shortage or drought event depending on its severity.

The Model Drought Ordinance was updated in April 2012, based on lessons learned during the during the 2007-2011 shortage period. This included updating the language to comply with the specific requirements of the UWMP Act regarding consumption reduction methods to address “up to a 50 percent reduction in water supply” (Water Code Section 10632 (a)). The updated retail agency ordinances that are in effect during the current Drought Emergency reflect the changes made to the Model Drought Ordinance.

7.3.4 Use of Penalty Rates

Penalty rates may be used by SDCWA to encourage conservation and reduce demand during a drought or other water supply shortage. If MWD allocates imported water supplies to SDCWA, MWD can impose surcharges (penalty pricing) on water consumption in excess of the SDCWA's allocation. The Water Authority's Implementing Resolution, provides for a pass through to the retail agencies of any penalties levied by MWD on SDCWA for exceeding its annual allocation. Penalties are assessed at the end of the fiscal or calendar year, depending on the class of service. Penalties will be assessed on a pro rata basis to the retail agencies that exceed their allocations, and only if the SDCWA exceeds its allocation from MWD. SDCWA is subject to significant financial penalties if it exceeds its Metropolitan allocation. Rates may also be adjusted based on any other allocation program implemented by SDCWA as determined necessary by the Board of Directors. SDCWA may also reduce the amount of water it allocates to a member agency if the member agency fails to adopt or implement water use restrictions.

In April 2015, a modification was made to SDCWA’s procedures in imposing penalties on member agencies for exceeding their individual allocations. The modification was in response to the Governor’s call for heightened drought response actions due to the severity of the current 4-year drought. Under the existing policies member agencies would receive a financial penalty for exceeding their allocation only if SDCWA's annual deliveries exceed its supply allocation from MWD. This allowed some agencies to potentially underperform and exceed their allocation without receiving a financial penalty. The modification allows SDCWA to assess a monetary penalty on any member agency deliveries that exceed either their M&I or TSAWR supply allocation from the Water Authority, even if the Water Authority does not exceed its annual allocation from MWD. This provision would help enforce the need to meet the SWRCB conservation targets and is only in place for the current allocation period.

7.4 SDCWA Dry-Year Supplies and Carryover Storage

The SDCWA's dry-year supplies and carryover storage are an important component of managing potential shortages within the region and for increasing supply reliability for the region. The dry-year supplies assist in minimizing or reducing potential supply shortages from MWD. Over the last five years the SDCWA has developed a carryover storage program to more effectively manage supplies. This includes in-region surface storage currently in member agency reservoirs and increasing capacity through the raising of San Vicente Dam. The SDCWA also has an out-of-region groundwater banking program in the California central valley. Through these efforts, the SDCWA can store water available during wet periods for use during times of shortage. The SDCWA also implemented a dry-year transfer program during the last shortage period and successfully acquired and utilized dry-year transfer supplies in 2009. The SDCWA's carryover storage and dry-year transfer programs are discussed below.

7.4.1 SDCWA Carryover Storage Program

The carryover storage program provides water for the region in the case of a supply shortage, such as during a drought. The SDCWA has identified three main needs for carryover storage:

- Enhance reliability of the water supply: During dry weather periods, increased regional demand for water may exceed available supplies, resulting in potential water shortages. Carryover storage provides a reliable and readily available source of water during periods of shortage, such as during dry years.
- Increase system efficiency: Carryover storage provides operational flexibility to serve above normal demands, such as those occurring during peak summer months or extended droughts, from locally stored water rather than by the over-sizing of the SDCWA's imported water transmission facilities.

- Better management of water supplies: Carryover storage allows the SDCWA to accept additional deliveries from its existing State Water Project- and Colorado River-derived sources during periods of greater availability, such as during wet years, to increase water availability locally during periods of shortage, such as during dry years.

San Vicente Dam Raise Carryover Storage Project

The SDCWA's Water Facilities Master Plan (December 2002) identified a need for approximately 100,000 AF of carryover storage to assist in maintaining a secure and reliable supply for the region.

The San Vicente Dam Raise CSP will meet this need by providing approximately 100,000 acre-feet of local storage and facilitate the reliable and efficient delivery of water to residents of the SDCWA service area. It is located in the San Vicente Reservoir above the reservoir expansion for the ESP, and will increase water storage reliability for commercial agricultural users paying the full basic M&I water rate.

Water Authority's Out-Of-Region Groundwater Program

As part of the Quantification Settlement Agreement, the Water Authority became the recipient of groundwater conjunctive use funds appropriated through Senate Bill 1765 (1998), which originally were designated to MWD. Approximately $30.5 million was made available to the Water Authority for use in its groundwater program. A demand and supply analysis utilizing data from SDCWA's 2005 Urban Water Management Plan identified a maximum potential need for approximately up to 95,000 acre-feet of additional carryover storage beyond the 100,000 acre-feet of carryover storage at San Vicente Reservoir. This evaluation looked at a three-year dry cycle scenario during which demands are high and imported supplies are constrained by preferential rights. Based on that scenario, the Water Authority distributed a Request for Proposal (RFP) in November 2005 to partner with agencies overlying a groundwater basin for a conjunctive use project. The project would allow water to be delivered and stored during above normal hydrology and extracted from the basin and delivered to the Water Authority either by wheeling through various facilities, exchanges, or other alternatives.

In 2008, SDCWA acquired a total of 70,000 acre-feet of permanent storage allocation in the Semitropic-Rosamond Water Bank Authority and Semitropic Water Bank (40,000 acre-feet and 30,000 acre-feet respectively) located in Kern County. Due to its location near the California Aqueduct, the Kern River and the Friant-Kern Canal, the location was ideally suited for groundwater banking. The Water Authority's assigned rights also included a total Program Delivery Capacity of 12,715 acre-feet per year and 10,865 acre- feet per year of Program Pumpback Capacity.

7.4.2 Utilization of Carryover Storage Supplies

In accordance with the Water Authority's WSDRP, potential utilization of carryover storage supplies could occur in Stage 2, Supply Enhancement, or Stage 3, Mandatory Cutbacks. The amount of water taken from carryover storage reserves, to manage potential shortages, is influenced by a number of factors and should generally be handled on a case-by-case basis. Many of the factors influencing the storage take will vary depending upon conditions present. These factors include, but are not limited to:

- Current water demand trends;
- Core water supply availability from imported and local sources;
- Existing and projected hydrologic conditions;
- Storage supply available for withdrawal;
- Take capacity from the groundwater banking program; and
- Need to avoid depletion of storage reserves.

Agricultural customers paying the full basic M&I water rate will receive enhanced reliability from the use of Carryover Storage supplies as those supplies will be part of their retail agency’s allocation of water under WSDRP. Customers in the SAWR class of service are exempt from paying SDCWA’s storage charge and in turn receive no water from the Carryover Storage Program during Stage 2 or 3 of the WSDRP.

7.4.3 SDCWA Dry-Year Transfer Program

Agricultural customers paying the full basic water rate can also benefit from enhanced reliability provided by dry year water transfers. SDCWA, on behalf of the region has purchased transfer water from water agencies in northern California as a strategy to improve dry year shortages. Agricultural users participating in the SAWR pay only for MWD water and therefore do not receive the reliability benefit of dry year transfers that their retail agency receive as part of their overall water allocation under WSDRP.

To ensure adequate water supplies resulting from continuing drought conditions (2007 - 2011) and regulatory constraints, and as part of the WSDRP, staff developed a plan to secure one-time water transfer agreements, which could lay the foundation for long-term agreements as authorized by the Board on September 27, 2007. Although transfers of water supplies through the Delta may be subject to curtailments during certain periods due to operations of the pumps in the SWP system, staff pursued opportunities as a supply option in the event that Colorado River surplus was suspended or dry-year conditions continue. The supply could also hedge against shortfalls resulting from a reduced State Water Project allocation.

In 2009, SDCWA acquired 20,000 acre-feet of water under a one-year transfer agreement with Placer County Water Agency in Northern California to lessen the impact of water supply reductions on the San Diego region. The transfer eased the region's transition from voluntary conservation to mandatory water use restrictions by keeping regional water savings target for the year at a manageable level. In 2010, the SDCWA actively sought water transfer options, however, due to the changed conditions in the region’s water demands, which had significantly dropped since MWD enacted Level 2 of its Water Supply Allocation Plan in July 2009, the expense necessary to obtain the necessary approvals and agreements and the comparatively higher cost of the supplies, the board approved not exercising its call rights to the 2010 dry-year transfer with the South Feather Water and Power Agency.

Considerations that shaped negotiations between SDCWA and the potential partners included:

- *Source Location*: To mitigate the delivery risks through the Delta, staff pursued transfers as a part of DWR's Dry Year Program, which had a wheeling priority in the Delta. In addition, staff investigated temporary storage agreements with DWR and the USBR in Lake Oroville or Lake Shasta to store the conserved water for when releases would be permitted.
- *Federal and State Agency Approvals*: Potential programs may have required environmental compliance and approval from overseeing agencies, such as the USBR and DWR.
- *Price:* The cost for water purchase, transportation, conveyance losses, and environmental/administrative fees should be comparable to the costs of other supply alternatives such as Metropolitan's Tier 2 purchases and IID transfers. In addition, staff made efforts to not drive the costs up of potential proposals by Metropolitan with the Northern California water districts.

- *Call Period*: Potential partners were seeking earlier call dates to ensure time to conserve the call amount. The Water Authority sought a balance that would provide a later call date opportunity due to changing weather conditions or water opportunities.
- *Available Capacity in the SWP system*: Consideration was made due to the uncertainty of the SWP pump operations and available capacity in the SWP system.

During the current Drought Emergency there has been very little if any agricultural water available for dry year transfers due to the severity of water supply conditions. The region has not used dry year transfers to supplement existing supplies during this 4-year period of dry weather.

Sources

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWM*P). June

http://www.sdcwa.org/, November 2014. Water Planning Committee Board Report

http://www.sdcwa.org/, April 2015. Water Planning Committee Board Report

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8. Water Use

Regional Planning

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8 Water Use

8.1 Overview

The predominant use of water in the region is for Municipal and Industrial (M&I) uses. M&I water use accounts for 80-85% of all water used in the region. M&I water use includes domestic consumption in developed and rural residential areas, and to a lesser extent commercial, industrial and institutional uses of water. Agricultural water use has accounted for 15%-20% of the region's water use for the last 30 years. Recreational uses of water are related to the use of locally owned reservoirs serving as surface water impoundments for drinking water. Environmental Wear uses are incidental to the operation water supply facilities or in compliance with state and federal permits. These water uses are described in greater detail in the remainder of this section.

8.2 Agricultural Use

Agricultural production within the SDCWA service area is concentrated mainly in the northern part of San Diego County, with the top five agricultural member agencies being: the City of Escondido, Fallbrook Public Utility District, Rainbow Municipal Water District, Valley Center Municipal Water District, and Yuima Municipal Water District. In fiscal year 2013, these five agencies represented over 90 percent of the total agricultural water use within the SDCWA boundaries.

SDCWA conducted detailed estimates of agricultural acreage in 2007 and 2013 using a new assessment methodology it developed to estimate agricultural lands based primarily on geographic information system (GIS) data provided by the County of San Diego. In its most recent *Agricultural Acreage Assessment (2014)*, SDCWA identified agricultural lands within the region totaling approximately 52,000 acres. This acreage is classified into nine crop categories based on water usage characteristics. Water use for the nine categories differ based on their respective crop-type evapotranspiration rates and crop coefficients. Table 8-1 shows the nine categories used to classify agricultural crop-types.

Table 8-1 Agricultural Crop-Type Categories

Class	Crop-Type Category
1	Avocado Trees
2	Citrus, Subtropical Trees
3	Fruits, Nuts, Grapes
4	Vegetables, Flowers, Berries
5	Greenhouses
6	Nursery
7	Grain, Hay, Pasture
8	Non-irrigated Oat, Wheat, Range
9	Sod Farms, Turf

Avocado groves represent the largest single category at 23, 440 acres, or just under 45 percent of the total acreage. Between 2007 and 2013 the region saw a 12% reduction in overall irrigated acreage and an approximate 8% reduction in irrigated avocado acreage. Table 11-2 provides a comparison between the 2007 estimates and the 2013 assessment of average by classified crop type.

Table 8-2 Comparison of 2007 and 2013 Agricultural Acreage

Class	Crop-Type Category	2007	2013
1	Avocado Trees	25,533	23,438
2	Citrus, Subtropical Trees	7,504	7,793
3	Fruits, Nuts, Grapes	5,268	2,650
4	Vegetables, Flowers, Berries	10,164	7,979
5	Greenhouses	1,201	1,041
6	Nursery	5,503	5,009
7	Grain, Hay, Pasture	562	1,253
8	Non-Irrigated Oat, Wheat, Range	3,322	2,293
9	Sod Farms, Turf	554	874
TOTALS		**59,611**	**52,330**

The total agricultural acreage estimates were further broken down to individual SDCWA member agencies and displayed in Table 11-3. Agencies participating in the RAWMP are shown in Bold.

Table 8-3 Member Agency Breakdown of 2013 Agricultural Acreage

Member Agency	Acreage
Carlsbad M.W.D.	**785**
Del Mar, City of	0
Escondido, City of *	**1,867**
Fallbrook P.U.D.	**4,912**
Helix W.D.	25
Lakeside W.D.	51
National City, City of	1
Oceanside, City of	**2,067**
Olivenhain M.W.D.	**592**
Otay W.D.	794
Padre Dam M.W.D.	985
Pendleton M. R.	1,158
Poway, City of	**438**
Rainbow M.W.D.	**9,866**
Ramona M.W.D.	**2,987**
Rincon Del Diablo M.W.D. *	**272**
San Diego, City of	3,158
San Dieguito W.D.	**209**
Santa Fe I.D.	**479**
South Bay I.D.	38
Vallecitos W.D.	**1,475**
Valley Center M.W.D.	**15,005**
Vista I.D.	1,156
Yuima M.W.D.	**4,010**
TOTAL	**52,330***

*Acreage totals based on member agencies' areas served, and not standard service area boundary.

Note: Agencies in Bold are participants in RAWMP and have detailed descriptions in Part II

Agricultural demand projections used in the 2010 Urban Water Management Plan (UWMP) were developed through a cooperative effort between SDCWA staff, its member agencies, SANDAG, County of San Diego Agricultural Weights and Measures, and the California Avocado Commission. Forecast driver variables include irrigated acreage within the Water Authority's service area, estimated crop type distribution, and calculated historic water use factors. SANDAG's projection of agricultural land conversions to other land use categories, provides the long-term trend in acreage used to forecast agricultural water use. In forecasting future agricultural water use SDCWA’s agricultural model utilizes irrigated agricultural acreage, distribution of acreage among crop types, average water requirements for each crop category, and the influence of weather and price of water as predictive variables. Table 8-4 below provides a projection of total agricultural water demand in the region from 2020 through 2035 based on the SDCWA’s 2010 UWMP. That projection is currently be updated for the 2015 plan.

Table 8-4 Projected Agricultural Water Demand to 2035

2020	2025	2030	2035
49,534	48,380	47,279	46,178

Farmers in San Diego County have the overriding concern of the cost of water as their single largest production cost. This applies to those growers participating in the SDCWA’s TSAWR program averaging $1300/AF or those purchasing full price M&I water for its reliability benefits at prices over $1,500/AF. This high cost factor drives the need and focus by the region’s farmers for irrigation efficiency and actual water use, although not uniform in the region tends to demonstrate that irrigation is below reference ET and crop coefficients. Many growers use efficient micro-spray systems and as recommended by the California Avocado Commission aim for an 80 percent irrigation efficiency factor. Fortunately, an insignificant amount of water is needed for cultural practices such as frost control, dust control and pesticide application. However, a reasonable 10% leaching factor is expected to drive salt build ups past the root zone.

Table 8-5 provides the agricultural water use for the region in FY 2013-FY 2015. For individual agency agricultural water use see Part II of the RAWMP.

Table 8-5 Regional Agricultural Water Use FY 13-FY 15

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	Total
FY 2013	5,546	6,305	5,995	5,369	3,974	2,169	1,602	1,891	2,573	3,848	4,546	5,244	**49,064**
FY 2014	5,587	5343	5,778	4,529	3,235	2,853	3,942	3,257	2,113	3,725	5,086	5,117	**50,565**
FY 2015	5,753	5,597	3,805	5,732	5,487	4,702	3,661	4,235	4,694	5,006	5,229	4,752	**58,653**

8.3 Municipal and Industrial

Total retail M&I demand encompasses a wide range of water uses that include residential demand (water used for human consumption in the home, domestic purposes, and outdoor residential landscaping) and water used for commercial, industrial, and institutional purposes.

8.3.1 Residential Demand

Residential water consumption covers both indoor and outdoor uses. Indoor water uses include sanitation, bathing, laundry, cooking, and drinking. Most outdoor water use entails landscaping irrigation requirements. Other minor outdoor uses include car washing, surface cleaning, and similar activities. For single-family homes and rural areas, outdoor demands may constitute up to 60 percent of total residential use.

The estimated composition of San Diego's 2010 regional housing stock was approximately 60 percent single-family homes, 36 percent multi-family homes, and 4 percent mobile homes. Single-family residences generally contain larger landscaped areas, predominantly planted in turf, and require more water for outdoor application in comparison to other types of housing. The general characteristics of multi-family and mobile homes limit outdoor landscaping and water use, although some condominium and apartment developments do contain green belt areas.

8.3.2 Commercial and Industrial Demand

Commercial water demands generally consist of uses that are necessary for the operation of a business or institution, such as drinking, sanitation, and landscape irrigation. Major commercial water users include service industries, such as restaurants, car washes, laundries, hotels, and golf courses. Economic statistics developed by the San Diego Regional Chamber of Commerce indicate that almost half of San Diego's residents are employed in commercial (trade and service) industries.

Industrial water consumption consists of a wide range of uses, including product processing and small-scale equipment cooling, sanitation, and air conditioning. Water-intensive industrial uses in the city of San Diego, such as electronics manufacturing and aerospace manufacturing, typically require smaller amounts of water when compared to other water-intensive industries found elsewhere in Southern California, such as petroleum refineries, smelters, chemical processors, and canneries.

The tourism industry in San Diego County affects water usage within the Water Authority's service area not only by the number of visitors, but also through expansion of service industries and attractions, which tend to be larger outdoor water users. Tourism is primarily concentrated in the summer months and affects seasonal demands and peaking. SANDAG regional population forecasts do not specifically account for tourism, but tourism is reflected in the economic forecasts and affects per capita water use.

8.3.3 M& I Water Use

Table 8-6 provides the actual M&I water use for FY 2013-FY2015

Table 8-6 M&I Water Use (AF)

M&I Water Use (AF)						
	July	Aug	Sept	Oct	Nov	Dec
FY 2013	57,538	59,700	55,593	48,471	40,281	28,821
FY 2014	56,657	57,484	54,576	47,136	38,509	35,691
FY 2015	56,815	53,168	53,863	49,551	37,241	22,773

M&I Water Use (AF)							
	Jan	Feb	March	April	May	June	**Total**
FY 2013	30,376	28,398	37,242	43,688	49,869	54,445	**534,420**
FY 2014	41,418	32,939	35,726	42,945	54,744	54,299	**552,124**
FY 2015	28,323	30,468	36,645	39,975	32,598	39,288	**480,708**

8.4 Environmental

There are no designated environmental uses of water supply in the region and they are not accounted for by water suppliers but may be contained in reservoir operating permits with the California Department of Fish and Wildlife (DFW).

8.5 Recreational

Recreation use of water supply are secondary considerations in local drinking water impoundments. Water supply needs take priority over recreational uses in those impoundments.

8.6 Groundwater Recharge

There is no accounting for groundwater recharge in the region although it does take place incidentally through natural recharge. As noted in Section 10, groundwater is not a significant supply resource on a regional basis.

8.7 Other Uses

There are no Other Uses accounted for within the region.

Table 8-7 provides those water uses where there is no accounting.

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Table 8-7 Other Water Uses (No Accounting)

Environmental, Recreational, Groundwater Recharge and Other Uses													
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	**Total**
FY 2013	0	0	0	0	0	0	0	0	0	0	0	0	**0**
FY 2014	0	0	0	0	0	0	0	0	0	0	0	0	**0**
FY 2015	0	0	0	0	0	0	0	0	0	0	0	0	**0**

11.2. Transfers and Exchanges

As described in Section 9, SDCWA is a party to the largest agriculture to urban transfer in California history. Exchanges of water do take place between local water agencies. Table 11-8 and Table 11-9 provide SDCWA's Colorado River transfers and the aggregate exchanges between retail water suppliers for the FY 2013-FY 2015 period. A large portion of exchanges and transfers between retail agencies involve contractual arrangements for the treatment of water at local treatment plants owned by one agency and delivered to another agency.

Table 8-8 Regional Transfers (AF)

Regional Transfers (AF)													
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	**Total**
FY 2013	15,368	15,368	15,368	15,368.	15,368	17,807	14,808	14,808	14,808	14,808	14,808	14,808	**183,500**
FY 2014	14,808	14,808	14,808	14,808	14,808	17,364	14,808	14,808	14,808	14,808	14,808	14,808	**180,256**
FY 2015	14,808	14,808	14,808	14,808	14,808	17,231	14,808	14,808	14,808	14,808	14,808	14,808	**180,123**

Table 8-9 Inter Agency Transfers and Exchanges

Inter-Agency Transfers AND Exchanges													
00	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	**Total**
FY 2013	5,133	5,486	6,025	4,744	4,325	3,090	2,902	2,922	3,429	3,451	4,553	5,145	**51,203**
FY 2014	5,432	6,229	5,884	5,949	6,099	3,959	5,436	4,040	11,817	7,911	11,996	12,349	**87,100**
FY 2015	11,028	13,792	13,209	6,535	5,352	6,600	8,421	4,489	5,212	6,135	13,233	19,644	**113,648**

Sources

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWM*P). June

San Diego County Water Authority (SDCWA). 2014. *Agricultural Acreage Assessment*

9. Water Supplies and Hydrologies

Regional Planning

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9 Water Supplies and Hydrology

9.1 Overview

This section describes the various water supplies, water availability and hydrology in the region. In the last 25 years the San Diego region has gone from very little diversification in its sources of water supply to developing a resources mix that is one of the most diverse in the state. At the height of the 1987-1992 drought the San Diego region was 95% dependent on imported water supplied by MWD. As a result of severe limitations on available SWP supplies the San Diego County was facing economically catastrophic cutbacks of 50% for M&I and 90% for agriculture. That experience resulted in a long term commitment by water suppliers in the region to aggressively implement a resource management strategy of supply diversification. The regional diversification program included conservation, recycled water, agricultural water transfers, construction of new storage facilities and most recently seawater desalination.

Diversification efforts have been enormously successful in making the region much more reliable today than it was during the drought of 1987-1992. It is much better able to withstand variation in available imported water supplies due to prolonged drought and supply cutbacks. All of the supplies described in this section contribute to the overall reliability of the region. Improvements to regional reliability benefit agricultural water users, even those solely dependent on imported water. The decreased demand for imported water because of the availability of more reliable local supplies increased the availability of agricultural water supplies in times of imported water shortages.

9.2 Surface Water

Surface water supplies make up the predominant amount of water used in the region and account for almost all water used by agricultural customers. Surface water is divided into two categories, 1) local surface water from runoff collected in reservoirs owned and operated by local water agencies and 2) imported water conveyed to the local agencies by SDCWA. Most surface water comes from imported water sources purchased by SDCWA from several sources. Local surface water is available to several participating water agencies in limited quantities.

Imported water conveyed by SDCWA is predominantly from the Colorado River and comes from three sources, the Metropolitan Water District of Southern California (MWD), conserved agricultural transfer water from the Imperial Irrigation District (IID), and conserved agricultural water from the concrete lining of the All American Canal and the Coachella Canal. On a long term average basis, less than 20% of imported water used in the Region is from the State Water Project (SWP) and is purchased by SDCWA from MWD.

9.2.1 Local Surface Water

Surface water supplies represent the largest single local resource in SDCWA's service area. Local surface water users within the region hold various rights and are parties to agreements to divert available surface water in multiple watersheds in the region. Local surface water is of good quality for irrigation and is usually blended with imported surface water when delivered to individual irrigators.

However, annual local surface water yields can vary substantially due to fluctuating hydrologic cycles. The estimated total average annual inflow is roughly 100,000 AF, ranging from negligible inflow during an extremely dry year up to an historical high of 853,000 AF. Since 1980, annual surface water yields have ranged from a low of 4,100 AF in 2015 to a high of 140,300 AF in 1984. The average annual available surface water supply is lower than the average annual inflow due to reservoir evaporation, reservoir spills, and water uses and losses not directly accounted in the reservoir balance measurements.

The regional surface water yield is supported by 24 surface reservoirs with a combined capacity of 746,385 AF. The reservoirs are located in seven of the San Diego County's nine coastal watersheds. Table 12-1 lists the 24 reservoirs in the San Diego region. The runoff in these watersheds starts at the crest of the Peninsular Range and drains into the Pacific Ocean and is mostly developed. The oldest functional reservoir in the county, Cuyamaca Reservoir, was completed in 1887. Of the total surface storage capacity, the City of San Diego controls 56%, SDCWA, which owns and operates Olivenhain Reservoir, also has storage rights of 152,100 AF in San Vicente Reservoir for carryover and emergency storage, with the remainder controlled by the city. As a result, SDCWA controls 24% of the region's storage capacity. The remaining 20% is controlled by other member agencies. Based on the 2010 Urban Water Management Plan Update, the region's average annual local surface water yield is expected to range from 47,289 AF per year to 48,206 AF through 2035.

To optimize the use of local storage for the benefit of the entire region, SDCWA works with its member agencies through storage agreements and through the aqueduct operating plan. The aqueduct operating plans coordinate imported water deliveries and optimize reservoir fill opportunities. Local yield is maximized by the member agencies that operate the reservoirs.

Table 9-1 Major San Diego County Reservoirs

Member Agency	Reservoir	Capacity (AF)
Carlsbad Municipal Water District	Maerkle	600
Escondido, City of	Dixon	2,606
Escondido, City of	Wohlford	6,506
Fallbrook Public Utility District	Red Mountain	1,335
Helix Water District	Cuyamaca	8,195
Helix Water District	Jennings	9,790
Poway, City of	Poway	3,330
Rainbow Municipal Water District	Morro Hill	465
Ramona Municipal Water District	Ramona	12,000
San Diego County Water Authority (SDCWA)	Olivenhain	24,789
San Diego, City of	Barrett	34,806
San Diego, City of	El Capitan	112,807
San Diego, City of	Hodges	30,633
San Diego, City of	Lower Otay	49,849
San Diego, City of	Miramar	6,682
San Diego, City of	Morena	50,694
San Diego, City of	Murray	4,684
San Diego, City of	San Vicente	249,358
San Diego, City of	Sutherland	29,508
San Dieguito Water District	San Dieguito	883
Sweetwater Authority	Loveland	25,400
Sweetwater Authority	Sweetwater	28,079
Valley Center Municipal Water District	Turner	1,612
Vista Irrigation District	Henshaw	51,774
Total (24 reservoirs)		**746,385**

The following Table 9-2 shows surface water yields for each of the past three years, in acre-feet, for the Water Authority service area.

Table 9-2 Local Surface Yield (AF)

2013	2014	2015
46,069	40,396	4,071

9.2.2 Imported Surface Water

SDCWA purchases imported water from three main sources: Metropolitan Water District of Southern California (MWD), conserved agricultural water from the Imperial Irrigation District (IID), and conserved water resulting from the concrete lining of the All-American and Coachella Canals. The latter two sources of Colorado River Water were made available to SDCWA and the San Diego region through the 2003 *Quantification Settlement Agreement* (QSA) SDCWA has also acquired spot water transfers to offset reductions in supplies from MWD during water shortage years (see Section 10.3).

MWD is Southern California's wholesale water agency, and SDCWA is the largest customer among MWD's 26 member agencies. MWD derives its water supply from two sources: the Colorado River and the State Water Project (SWP). Metropolitan owns and operates the Colorado River Aqueduct to deliver Colorado River water to Southern California. Metropolitan is the largest of the State Water Contractors that receive supplies from the SWP. SWP water (originating from the Bay Delta) is delivered to Metropolitan via the California Aqueduct.

As shown in Table 9-3, imported water supplies provided through SDCWA have comprised between 79 and 93% of the region's water supply in recent years. Except during periods of extreme drought, SDCWA supplies typically comprise approximately 80% of the region's water supply. Table 9-3 Composition of Water Supplies, Imported vs. Local, Fiscal Years 2001-2015.

Table 9-3 Mix of Imported and Local Supplies

Fiscal Year	Local Supplies (AF)	Imported Supplies (AF)	Total (AF)	% Imported
2001	82,247	564,140	646,387	87.3
2002	70,957	615,572	686,530	89.7
2003	62,773	586,849	649,622	90.3
2004	49,755	666,008	715,763	93.0
2005	71,797	573,048	644,845	88.9
2006	110,633	576,620	687,253	83.9
2007	80,584	661,309	741,893	89.1
2008	83,029	608,903	691,931	88.0
2009	88,111	555,789	643,900	86.3
2010	71,483	494,960	566,443	87.4
2011	110,101	416,844	526,945	79.1
2012	102,886	439,552	542,438	81.0
2013	93,853	480,048	573,901	83.6
2014	88,551	505,985	594,536	85.1
2015	48,076	485,162	533,238	91.0

9.2.2.1 Colorado River Water

SDCWA-IID Water Transfer and Conservation Agreement

In 1998, SDCWA entered into a transfer agreement with IID to purchase conserved agricultural water. MWD conveys the IID transfer water to SDCWA via an exchange agreement. Water conserved by Imperial Valley farmers or through system efficiency improvements within the IID system can be transferred to SDCWA for use in San Diego County. Deliveries into San Diego County from the Transfer Agreement began in 2003 with an initial delivery of 10,000 acre-feet (AF). SDCWA is to receive increasing amounts of transfer water according to a water delivery schedule contained in the transfer agreement. In 2012, the Water Authority received 106,722 AF. The quantities will increase annually to 200,000 AF by 2021 and then remain fixed for the duration of the agreement. The initial term of the Transfer Agreement is 45 years, with a provision that either agency may extend the agreement for an additional 30-year period.

Based on the terms and conditions in the Transfer Agreement, conserved transfer water will ramp up from its current level of 100,000 acre feet to full deliveries of 200,000 acre feet beginning in 2021. The volume then remains fixed for the remainder of the 75-year agreement. The water available under the Transfer Agreement is considered highly reliable. During dry years, when Colorado River water availability is low, the conserved water will be transferred under IID's Colorado River rights, which are among the most senior in the Lower Colorado River Basin. Without the protection of these rights, the Water Authority could suffer delivery cutbacks. The water available under the Transfer Agreement is linked to the QSA.

Conserved Water from Coachella and All American Canal Linings

Through the 2003 Quantification Settlement Agreement (QSA) on the Colorado River, the Water Authority also receives 77,700 acre feet per year of conserved water from lining of the All-American (AAC) and Coachella Canals (CC) for 110 years. The projects reduced the loss of water that occurred through seepage, and the conserved water is also delivered by MWD to SDCWA through the Colorado River Aqueduct (CRA).

The AAC lining project makes 67,700 AF of Colorado River water per year available for allocation to the Water Authority and San Luis Rey Indian water rights settlement parties. The CC lining project makes another 26,000 AF of Colorado River water each year available for allocation, bringing the total amount of conserved water to 93,700 AF. The 2003 Allocation Agreement provides for 16,000 AF/YR of the total amount of conserved canal lining water to be allocated to the San Luis Rey Indian Water Rights Settlement Parties. The remaining amount of conserved water, or 77,700 AF/YR, is to be available to SDCWA.

An additional 4,850 AF/YR is also available to SDCWA depending on environmental requirements from the CC lining project. For planning purposes, SDCWA assumes that 2,500 AF of the 4,850 AF will be available each year for delivery, for a total of 80,200 AF/YR. The canal lining contracts are in effect for a period of 110 years. Both canal-lining projects have been completed, and full deliveries of conserved water to the San Diego region are occurring.

MWD Colorado River Supplies

During the 1930s, MWD built the CRA to convey Colorado River water from Lake Havasu on the Arizona/California border to Lake Mathews in Riverside County. The aqueduct has the capacity to deliver up to 1.25 MAF/YR. Before 1964, MWD had a firm annual allocation of 1.212 MAF of Colorado River water through contracts with the U.S. Department of the Interior, which was enough to keep MWD's aqueduct full. However, as a result of the U.S. Supreme Court decision in *Arizona vs. California*, MWD’s firm supply fell to 550,000 AF/YR, its basic annual apportionment.

Water availability from the Colorado River is governed by a system of priorities and water rights collectively known as the “Law of the River.” The Colorado River Lower Basin states (California, Arizona, and Nevada) have an annual apportionment of 7.5 million AF of water divided as follows: (1) California, 4.4 million AF; (2) Arizona, 2.8 million AF; and (3) Nevada, 300,000 AF. The 1931 Seven Party Agreement established California priorities for water among California’s contractors to use Colorado River water made available to California. The first four priorities total the 4.4 million AF/YR available to California. MWD has priorities 4, 5(a), and 5(b) water listed in the Seven Party Agreement, but only priorities 1–4 of the Seven Party Agreement are within California’s basic annual apportionment. MWD’s fourth priority of 550,000 AF is junior to that of the first three priorities, 3.85 million AF to California agricultural agencies. Water used to satisfy MWD’s priorities 5(a) and 5(b) must come from unused allocations within California, Arizona, or Nevada, or from surpluses declared by the Secretary of the Interior.

With the 2003 QSA and related agreements among the IID, CVWD, State of California, Department of Interior, MWD, and SDCWA, a plan was formalized on how California will implement water transfers and supply programs that allow California to live within the state’s 4.4 million AF basic annual apportionment of Colorado River water. Since then, MWD has relied on cooperative transfer programs and storage programs to increase its Colorado River water deliveries beyond its basic priority 4 water. In 2007, the Bureau of Reclamation released the Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead (Reclamation, 2007), which describes the process for improving operations of Lake Powell and Lake Mead during times of low storage conditions. A significant component of the Guidelines was the ability for Lower Basin states to store intentionally created surplus (ICS) water (conserved water) in Lake Mead for use in subsequent years. California has the ability to develop and store up to 400,000 AF per year or a maximum of 1.5 million AF in Lake Mead. MWD has been the largest user of the ICS mechanism to date.

During dry and multiple dry years, MWD, in its *2010* Regional Urban Water Management Plan, continues to target a full CRA of 1.25 million AF. This figure includes MWD’s basic apportionment deliveries, water management programs such as those described previously, and IID/SDCWA transfers and conserved canal-lining water conveyed through the CRA to SDCWA, land fallowing in Palo Verde, or when the U.S. Secretary of Interior declares surplus or unused water by Arizona and/or Nevada), and additional supplies when the Department of Interior declared surplus flows are available.

The Colorado River Basin states and the Bureau of Reclamation prepared the long range Colorado River Basin Supply and Demand Study to evaluate the reliability of the system over a range of future conditions. Climate change and growth in demand throughout the Basin are expected to further challenge long-term water management. Climate change itself may reduce the long-term Colorado River supply by more than 9 percent by 2060. The study included evaluations of the system reliability under baseline and alternative future portfolios of water management actions. The risk of Lower Basin shortages was found to be increasing through 2060 due to both decreasing projected supply and increasing consumptive uses. Specific risks to individual entitlement holders were not evaluated in the study.

9.2.2.2 State Water Project

MWD has a take-or-pay supply contract with the State of California and is entitled to take about 48 percent of available SWP water through its Long-Term SWP Water Supply Contract (Table A allocation). The project stretches more than 600 miles, from Lake Oroville in the north to Lake Perris in the south. Water is stored at Lake Oroville and released when needed into the Feather River, which flows into the Sacramento River and to the Sacramento-San Joaquin River Delta (Delta). The Delta is the largest estuary on the United States' west coast and is also home to an agricultural industry, recreation and fishing, and provides the means by which to deliver water from Northern California to the south. In the north Delta, water is pumped into the North Bay Aqueduct for delivery to Napa and Solano counties. In the south Delta, water is diverted into the SWP's Banks Pumping Plant, where it is lifted into the 444-mile-long California Aqueduct. Some of this water flows into the South Bay Aqueduct to serve areas in Alameda and Santa Clara counties. The remainder flows southward to cities and farms in central and southern California. In the winter, when demands are lower, water is stored at the San Luis Reservoir located south of the Delta. SWP facilities provide drinking water to 23 million Californians and 755,000 acres of irrigated farmland.

MWD’s currently contracted entitlement for SWP water (Table A) is 1,911,500 AF. In addition, during wet years when excess water is available and the San Luis Reservoir is full, SWP contractors may receive additional water deliveries (Article 21). However, the reliability of SWP supplies is dependent on both the hydrology of the Sacramento San Joaquin watershed and pumping restrictions in the Delta due to state and federal environmental regulations. Since the 1970s, additional restrictions on SWP operations have been enacted under the State Water Resources Control Board (SWRCB) water rights decisions, federal biological opinions, and interim court decisions. The most significant of these restrictions began in 2007 when federal biological opinions for Delta smelt and salmon were invalidated in federal court. The interim measures and subsequent revised biological opinions have substantially reduced water deliveries for the SWP through limits on exports during months of critical fish concerns (December through June).

The State of California Department of Water Resources *2009 State Water Project Delivery Reliability Report* updated DWR's estimate of the current and future water delivery reliability of the SWP. The 2009 report showed that future deliveries will be further impacted by significant restrictions due to operational requirements contained in federal biological opinions and forecasted effects of climate change and sea level rise. Under the reliability report, long-term average (1922–2003 hydrology) SWP allocations are estimated to be approximately 60 percent of the Table A demands, while single dry-year (1977) deliveries could be as low as 7 percent. Under future conditions, single dry-year deliveries are estimated to be approximately 11 percent, while long-term average allocations are estimated to remain at 60 percent. The future allocations translate into long-term average SWP deliveries to MWD of approximately 1.15 million AF and approximately 134,000 AF under single dry-year conditions.

In 2006, a voluntary collaboration of state, federal, and local water agencies; state and federal fish agencies; environmental organizations; and other interested parties began development of the Bay Delta Conservation Plan (BDCP). The purpose of the BDCP is to restore and protect Delta water supply, water quality, and ecosystem health within a stable regulatory environment. The BDCP is designed to provide the basis for the issuance of endangered species permits for the operation of state and federal water projects, and would be implemented over the next 50 years. Draft documents outlining the BDCP strategy and assessments were released on December 13, 2013 for a 108-day public review period.
The BDCP issued a partially Recirculated Draft EIR/ Supplemental DEIS under the renamed California WaterFix. Environmental restoration efforts that were contemplated under the BDCP will be done separately through a separate program known as EcoRestore. Under current WaterFix alternatives, new Delta conveyance, water operations, and mitigation are proposed to address the long-term issues in the Delta. In developing its projection of supply delivery capabilities, MWD assumed a new Delta

conveyance as fully operational by 2022, which would return supply reliability similar to 2005 conditions, prior to supply regulatory restrictions impacts.

For future conditions, it is the restrictive operational requirements coupled with the forecasted effects of climate change. MWD's SWP deliveries projection are updated based on periodic updates of DWR's SWP Reliability Report. In developing its supply capabilities, MWD assumed in its RUWMP a new Delta conveyance as fully operational by 2022 and would return supply reliability similar to 2005 conditions, prior to supply regulatory restrictions imposed. MWD also assumed near-term improvements that could potentially provide a 10% increase in water supplies obtained from the SWP allocation for the year. As of this RUWMP these additional supplies are not available although MWD still seeks to firm up interim reliability of the SWP as part of the BDCP and California WaterFix process. MWD developed its Central Valley storage and transfer programs to increase its supply capabilities.

MWD's is currently updating its *Integrated Resource Plan* (IRP) that will identify target s for SWP supply and supporting programs. MWD has about 30 storage programs in operation that provide flexibility to meet delivery requirements. The storage accounts include groundwater and surface storage programs and facilities, within and outside of MWD's service area. MWD's dry-year storage portfolio has the potential to store more than 5 million AF. It is expected that MWD's Central Valley transfer and storage program supplies will continue to be the foundation of its dry year reliability strategy for the SWP and its 2015 RUWMP will reflect current assumptions on timing and yield from the proposed California WaterFix.

Table 9-4 shows imported supplies for each of the past three years, in acre-feet, for the Water Authority service area.

Table 9-4 . Imported Supplies (AF)

2013	2014	2015
480,048	505,985	485,162

9.3 Groundwater Supply

9.3.1 Overview

Groundwater is available in very limited quantities throughout the region, and its use for irrigation is not regulated. Groundwater quality varies within the region, with high salinity affecting its suitability in some areas, but is generally of good quality when used for irrigation. Within the past five years, water supply agencies within the region have produced an annual average of approximately 18,300 AF of potable water supplies from groundwater. This total represents production from both brackish groundwater desalination facilities and municipal wells producing groundwater not requiring desalination. It does not include production from privately owned water wells used for irrigation and domestic purposes, or several thousand acre-feet of groundwater produced annually from the Warner Basin by Vista Irrigation District, but discharged to Lake Henshaw, a surface water reservoir, then released downstream of the dam.

In addition to providing a local supply to water agencies, groundwater is also a source of supply for numerous private well owners who draw on groundwater to help meet their domestic and agriculture water needs. In the Ramona area alone, over 1,000 privately owned wells provide a supplementary source of water for Ramona MWD customers. Similar domestic uses occur throughout the region. These domestic supplies help to offset demand for imported water. Although the amount of groundwater pumped by private wells is significant, it cannot be accurately quantified nor estimated within the RAWMP planning area.

While some community well systems outside SDCWA service area maintain records of overall water production, very few wells are required to be metered for production. As a result, it is difficult to estimate the overall quantity of water supplies used. The low-density residential population in this area uses a small fraction of water when compared to the overall regional supply. However, non-residential water use within this area (e.g. agriculture, golf courses, campgrounds, resorts, retreat centers, public parks, casinos, hotels, and industrial uses) can represent a sizable demand on available groundwater resources.

Shallow and narrow river valleys filled with alluvial sand and gravel deposits are characteristic of the more productive groundwater basins in the San Diego region. Outside of these more productive aquifers, groundwater is developed from fractured crystalline bedrock and semi-consolidated sedimentary deposits that occur throughout the region. However, yield and storage in these aquifers are limited, and the aquifers are best suited for meeting domestic water needs that do not require higher flow rates. Figure 12-X shows the location of the principal alluvial groundwater basins within the RAWMP planning area.

Within San Diego County, several hydrogeological environments exist. These different environments can be grouped into three generalized categories: fractured rock aquifers, alluvial and sedimentary aquifers, and desert basins. The RAWMP study area is underlain primarily by fractured rock aquifers and alluvial and sedimentary aquifers which are generally discussed below. The water suppliers included in this RAWMP do not overlay desert basins and those will are not addressed in the Plan.

Fractured Rock Aquifers

Fractured rock underlies a very large portion of San Diego County. These rocks are typically crystalline or metavolcanics associated with the Peninsular Ranges batholith of southern California and Baja California. The majority of the mountainous region of the County consists of these fractured rocks. Fractured rock aquifers are present in the foothills and mountainous regions where precipitation is higher than in the lower elevation regions. As a result, recharge rates to fractured rock aquifers can be greater than in the lower elevation areas. Additionally, due to the low storage capacity, recharge to fractured rock aquifers can cause relatively fast rises to the water table, and similarly fast declines to the water table from groundwater pumping in years without significant recharge.

In some areas of the County with particularly low storage, the static groundwater levels (as measured in unpumped wells) have risen or declined in excess of 100 feet in particularly rainy seasons or dry seasons, respectively. Fractured rock aquifers typically have much less storage capacity than aquifers comprised of unconsolidated sediments. Storage in fractured rock within the County spans several orders of magnitude from essentially zero and up to 1 percent of the total volume of the aquifer. Specific yield values in San Diego County fractured rock are estimated to range from about 0.001% to 1%. In many cases, fractured rock aquifers are overlain by a layer of weathered bedrock (residuum) and/or a layer of alluvium. The presence of residuum or alluvium may provide additional storage capacity if the water levels extend up into these layers. Water stored in these layers may drain into the fractured rock beneath them as water is pumped from the fractured rock. The additional storage in these surficial units may significantly enhance the availability of groundwater resources in some areas relying on groundwater from fractured rock.

Alluvial and Sedimentary Aquifers

Alluvial and sedimentary aquifers account for a relatively small area of the total region but are concerted in several watersheds where urban suppliers provide water to agricultural customers. These aquifers are typically found in river and stream valleys, around lagoons, near the coastline, and in the intermountain valleys. Sediments in these aquifers are composed of mostly consolidated (defined as sedimentary rock) or unconsolidated (defined as alluvium or colluvium) gravel, sand, silt, and clay. Most of these aquifers have relatively high hydraulic conductivity, porosity, and storage and in general would be considered good aquifers on the basis of their hydrogeological characteristics. However, many alluvial and sedimentary aquifers in the region have relatively thin saturated thickness and therefore limited storage. Alluvial and sedimentary aquifers can be underlain by fractured rock aquifers, which potentially provide additional storage.

Groundwater Recharge and Storage

Surface water bodies within an alluvial or sedimentary aquifer may increase the recharge due to leakage from the water body into the subsurface. Because alluvial basins generally occur in low-lying areas of a watershed, surface water runoff may accumulate in streams, lakes, or other surface depressions within alluvial basins and can provide an additional recharge source to these basins. Alluvial and sedimentary aquifers typically have significant storage capacity, with specific yield values between 1 and 30%. Wells in an alluvial or sedimentary aquifer typically yield relatively high volumes of water. Coarse-grained sediments such as sand or gravel typically produce higher volumes of water than finer-grained sediments such as silts or clays. In coarse-grained sediments, well yields may be hundreds to over a thousand gallons per minute (GPM) and are more limited by inefficiencies in the well itself or pump capacity, rather than by limitations in the aquifer's ability to produce water.

9.3.2 Groundwater Extraction and Disinfection Projects

Although groundwater supplies are less plentiful in the San Diego region than in some other areas of California, such as the Los Angeles Basin in southern California and the Central Valley in northern California, there are sufficient undeveloped brackish groundwater supplies exist that could help meet a greater portion of the region's future water demand. Several agencies within the region have identified potential projects that may provide several thousand to tens of thousands acre-feet of additional groundwater production in the coming years. Groundwater that can be extracted and used as a potable water supply, with little more than disinfection, generally occurs outside the influence of human activities and within the upper reaches of the east-west trending watersheds. Wells producing higher quality water are operated by MCB Camp Pendleton (Santa Margarita River watershed) and the Sweetwater Water Authority (San Diego Formation aquifer). The Vista Irrigation District also operates numerous high quality extraction wells in the Warner Basin, located in the upper San Luis Rey River watershed. The water from these wells is discharged to Lake Henshaw and eventually to the San Luis Rey River where it is then diverted further downstream for use in the city of Escondido and elsewhere. The unit cost of water produced from simple groundwater extraction and disinfection projects is low and generally well below the cost of imported water. Because most of the higher quality groundwater within the RAWMP study area is already being fully utilized, the focus for future local groundwater development is brackish groundwater recovery and treatment.

9.3.3 Brackish Groundwater Recovery Projects

Groundwater that is high in salts and total dissolved solids (TDS) and other contaminates, and requires advanced treatment prior to potable use, is typically found in shallow basins in the downstream portions of watersheds. Brackish groundwater recovery projects use membrane technology, principally reverse osmosis, to treat extracted groundwater to potable water standards. The city of Oceanside's 6.37-MGD capacity Mission Basin Desalter and the Sweetwater Authority's existing 4.0-MGD Richard A. Reynolds Groundwater Desalination Facility are the only currently operating brackish groundwater recovery and treatment facilities within the Water Authority's service area. Unit costs for brackish groundwater recovery projects are considerably higher than those for simple groundwater extraction and disinfection projects due to the additional treatment requirements and the cost of concentrate (brine) disposal. However, where economical options exist for disposal of brine, this type of groundwater project has proven to be an economically sound water- supply option.

9.3.4 Groundwater Recharge and Recovery Projects

Artificial recharge and recovery projects, also referred to as conjunctive-use projects, can increase groundwater basin yields by supplementing the natural recharge process. Conjunctive-use projects divert excess surface water supplies to percolation basins or injection wells to supplement natural rainfall runoff recharge. Captured rainfall runoff, reclaimed water, imported water, or a combination thereof, can be used to recharge groundwater basins when water levels have been lowered sufficiently by pumping. Groundwater basins can be operated similar to surface water reservoirs to supply stored water to the region if imported deliveries are limited due to high demand, or supply and facility constraints, or a combination thereof. The Fallbrook PUD and MCB Camp Pendleton, and Padre Dam MWD and Helix WD are currently exploring the feasibility of such projects.

Table 9-5 shows groundwater supplies for each of the past three years, in acre-feet, for the Water Authority service area. Totals include brackish groundwater reclamation.

Table 9-5 . Groundwater Supplies, including Brackish Groundwater (AF)

2013	2014	2015
20,393	19,223	17,520

9.4 Water Reuse

Beneficial reuse of wastewater is an important component of the Region's local water resources, both now and in the future. Water reuse includes non-potable reuse and potable reuse - in both cases secondary treated wastewater receives additional treatment to match its quality to the intended use. Non-potable reuse involves production of tertiary-treated recycled water in accordance with Title 22 of the California Code of Regulations. Non-potable recycled water, discussed in detail below, is used today throughout the Region for irrigation, toilet flushing, and industry. Although potable reuse is not currently part of the Region's water supply, it is being actively studied and pursued in the Region. Potable reuse involves advanced treatment of tertiary- quality recycled water to create purified water, which is similar in quality to distilled water, and as its name suggests, can be added to drinking water supplies.

Water reuse can increase water supply reliability by increasing the availability of local supplies and reducing the need to import water from outside the Region. The benefits of water reuse can include cost savings, energy savings, reduced wastewater discharges, avoidance of the need for peak surface water treatment capacity, improved water quality, and reduced fertilizer application needs when used for irrigation.

9.4.1 Non-Potable Reuse

Non-potable reuse is implemented in the region by retail water agencies and wastewater utilities. Currently approximately 26,000 acre feet or 5%, of the region's supply is provided by non-potable recycled water meeting the state's Title 22 requirements. Thirteen of the fifteen participating retail water suppliers in the RAWMP either beneficially reuse or produce recycled water within the region that for non-potable uses. These uses include agricultural use for high value products grown by nurseries and others. Expansion of non-potable ruse is being explored for tree crops as water supply availability becomes more challenging and potable water prices continue to dramatically increase. The historic challenge to increased recycled water use by agricultural customers has been the salt sensitivity of some crops, such as avocados, and the higher salinity of recycled water due to the predominance of Colorado River water as the source of wastewater recycling. The use of non-potable recycled water within the Region is projected to increase to approximately 50,000 AFY by 2035.

Since currently most recycled water is used for irrigation, recycled water demands vary substantially throughout the year, increasing in the dry summer months and decreasing in the wet winter months. A key and necessary component of water recycling is providing means of disposal or storage of excess recycled water supplies during periods of reduced demand. Local agencies may utilize either storage ponds or regional ocean outfall facilities to handle excess recycled water or wastewater flows during periods of wet weather or limited demand. An exception to this is Padre Dam MWD, which has a permit to discharge recycled water to the Santee Lakes, which overflows to the San Diego River.

Recycled water is primarily used to irrigate commercial landscaping, parks, campgrounds, golf courses, freeway medians, greenbelts, athletic fields, crops, orchards, and nursery stock. Recycled water is also used to augment supplies in recreational or ornamental lakes or ponds, control dust at construction sites, recharge groundwater basins, and for industrial cooling water. Because tertiary treated recycled water is higher in nutrients than potable water, this water source can also reduce the amount (and therefore the costs) of fertilizer application.

Since non-potable reuse doesn't require the pumping associated with water from the SWP or the Colorado River, it typically has lower energy needs and greenhouse gas emissions compared to imported potable water.

9.4.2 Potable Reuse

Although non-potable reuse is widespread in the Region, non-potable reuse alone does not achieve the full potential for beneficial reuse of wastewater. Potable reuse is another alternative under study as a means to increase water reuse. Potable reuse would involve advanced treatment of tertiary-quality recycled water to produce purified water, which would be similar in quality to distilled water (City of San Diego 2013). The purified water would then become part of the raw water supply, treated again at a drinking water treatment plant, and distributed through the existing potable water system. The health and safety of the drinking water is ensured by having multiple treatment barriers between recycled water and drinking water.

Several agencies - including the City of San Diego, City of Escondido, City of Oceanside, Padre Dam Municipal Water District, and San Elijo Joint Powers Authority - are exploring different technologies that would allow for future potable reuse. In the City of San Diego's 2006 *Water Reuse Study*, a group of stakeholders determined that the preferred option for water reuse would be to augment the City's San Vicente Reservoir with advance-treated purified water (City of San Diego 2013). This type of system is called indirect potable reuse through reservoir augmentation (IPR/RA), wherein the reservoir provides an environmental buffer in the string of multiple treatment barriers. The City of San Diego and the Padre Dam Municipal Water District are expeditiously advancing potable reuse projects that will enhance the reliability of the region's overall water supplies to the benefit of all agricultural water users.

Table 9-6 shows recycled water supplies for each of the past three years, in acre-feet, for the Water Authority service area.

Table 9-6 Recycled Supplies (AF)

2013	2014	2015
27,391	28,932	26,485

9.5 Seawater Desalination

The Water Authority in November 2012 approved a 30-year Water Purchase Agreement with Poseidon Resources for the purchase of up to 56,000 AFY of desalinated seawater. Poseidon Resources will own and operate the desalination facility and will assume risks associated with constructing, maintaining, and operating the facility, and ensuring that water quality meets standards specified within the agreement. The Water Authority, in turn, has agreed to purchase the water that meets specified standards at a set price during the 30-year agreement period. Additionally, the agreement specifies that the Water Authority can purchase the desalination plant for one dollar at the end of the 30-year agreement. Once constructed, the Water Authority will own and operate the 10-mile conveyance pipeline. Two of the RAWMP participating agencies, the Carlsbad MWD and the Vallecitos WD have agreed to purchase a total of 6,000 AFY of the desalinated water as a local supply. The Carlsbad Desalination Project began operations in December 2015 and providing desalted seawater to the region and will begin providing Carlsbad and Vallecitos their desalinated seawater local supply in January 2016. Since seawater desalination supplies were not available within the data collection period for this RAWMP there is no supporting table.

Figure 9-1 Facilities for Carlsbad Desalination Project

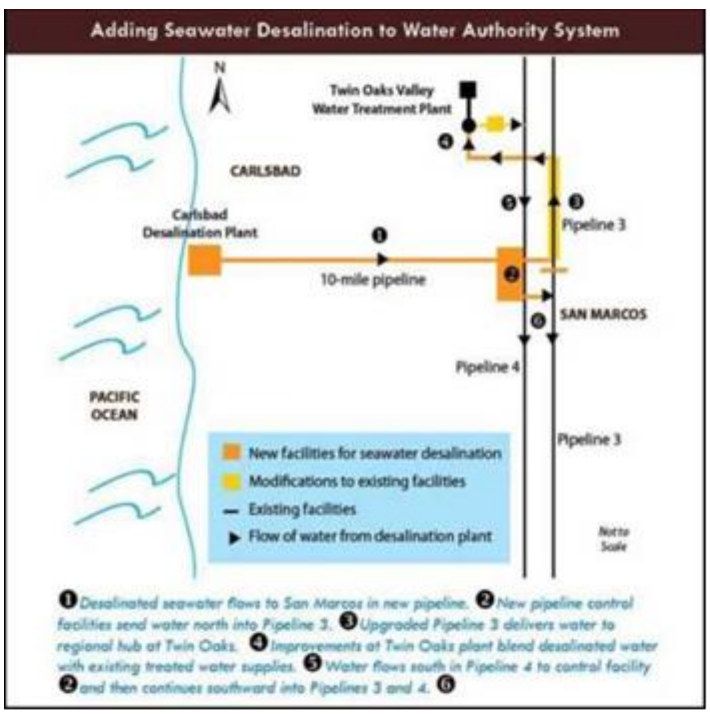

Table 9-7 summarizes all supplies, local and imported, for each of the past three years, in acre-feet, for the SDCWA service area.

Table 9-7 Summary of Water Supply Quantities (AF)

	Year		
Supply Source	**2013**	**2014**	**2015**
Local-Surface	46,069	40,396	4,071
Local-Groundwater	20,393	19,223	17,520
Local-Recycled	27,391	28,932	26,485
Local-Totals	93,853	88,551	48,076
Imported	480,048	505,985	485,162
Totals	573,901	594,536	533,238

9.6 Water Balance

Table 9-8 Regional Water Supply Balance

Year	Water Supplies	Water Use	Drainage Water	Balance
FY 13	573,901	583,484	0	(9,583)
FY 14	594,536	602,689	0	(8,153)
FY 15	533,238	539,361	0	(6,123)

Note: Negative numbers most likely indicate takes from storage from previous years supplies not tracked regionally and average less than 1.5% of total supplies

SOURCES

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWM*P). June

San Diego County Annual reports.

San Diego County Regional Water Management Group (RWMG). 2013 *Integrated Regional Water Management Plan*

San Diego County. 2011. *General Plan Update Final EIR*. August

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10. Water Quality

Regional Planning

Draft San Diego Regional Agricultural Water Management Plan: Part I

10 Water Quality

10.1 Introduction

San Diego County agriculture is irrigated with predominantly imported water supplies from SDCWA which now includes desalinated seawater. Several of the participating water suppliers in the RAWMP area deliver a supply that includes local surface water runoff, pumped groundwater and recovered brackish groundwater. There are also commercial growers located within some participating water suppliers that receive Title 22 compliant non-potable recycled water and plans are being made to expand the use of recycled water for avocado growers located in the City of Escondido. For many years, efforts by the UC Cooperative Extension and local water agencies have focused on working with growers to conduct practical research that would expand the use of recycled water while maintaining profitable avocado crop yields. This Chapter of the RAWMP provides water quality information on all sources of supply being used by local agriculture in the region now and anticipated as supply in the future.

10.2 Surface Water Supplies

Historically, regional surface water quality has been considered good to excellent. Water quality can vary with imported water inflows and surface water contamination. Source water protection is considered a key element in regional water quality. The region’s water suppliers are working together to improve watershed awareness and management. Currently, the most significant water quality issue that affects the public is algae blooms, which can create taste and odor problems.

In San Diego County, the State Water Resources Control Board’s (SWRCB) Division of Drinking Water (DDW) has primacy over the implementation of the federal Safe Drinking Water Act (SDWA). The SDWA regulates source water protection to ensure public health through the multiple barrier approach, an approach that anticipates that the public will participate in source water protection. Retail water agencies in the region that have surface water have a good, long-standing, working relationship with state health officials.

10.2.1 Colorado River Water

The Colorado River is the primary source of the region's imported water supply. High salinity levels, uranium, and perchlorate contamination represent the primary areas of concern with the quality of Colorado River supplies. Managing the watershed of the Colorado River has been the most effective method for controlling these elements of concern.

Salinity

The salts in the Colorado River System are indigenous and pervasive, mostly resulting from saline sediments in the basin that were deposited in prehistoric marine environments. They are easily eroded, dissolved, and transported into the river system. Agricultural development and water diversions over the past 50 years increase the already high naturally occurring levels of TDS.

Water imported via the CRA has a TDS averaging around 650 mg/l during normal water years. During the high water flows of 1983-1986, salinity levels in the CRA dropped to a historic low of 525 mg/l. However, during the 19871990 drought, higher salinity levels returned. During an extreme drought, CRA supplies could exceed 900 mg/l. High TDS in water supplies leads to high TDS in wastewater, which lowers the usefulness of the water and increases the cost of recycled water. (Refer to Section 8.5 for details on salinity impacts to water recycling.) In addition to the link between water supply and water quality, high levels of TDS in water supplies can damage water delivery systems and home appliances.

To reduce the effects of high TDS levels on water supply reliability, MWD approved a highly successful Salinity Management Policy in April 1999. One of the policy goals is to blend Colorado River supplies with lower-salinity water from the SWP to achieve delivered water salinity levels less than 500 mg/l TDS. Since 1999, the TDS levels in MWD's supply has ranged between 381 mg/l and 643 mg/l, with an average TDS of 500 mg/l. In addition, to fostering interstate cooperation on this issue, the seven basin states formed the Colorado River Basin Salinity Control Forum (Forum). To lower TDS levels in Colorado River supplies, the Forum develops programs designed to prevent a portion of the abundant salt supply from moving into the river system. The Colorado River Basin Salinity Control Program targets the interception and control of non-point sources, such as surface runoff, as well as wastewater and saline hot springs.

Perchlorate

Perchlorate is used as the main component in solid rocket propellant, and it can also be found in some types of munitions and fireworks. Perchlorate and other perchlorate salts are readily soluble in water, dissociating into the perchlorate ion, which does not readily interact with the soil matrix or degrade in the environment. The primary human health concern related to perchlorate is its effects on the thyroid. Perchlorate has been detected at low levels in MWD's CRA water supply.

Because of the growing concerns over perchlorate levels in drinking water, in 2002 Metropolitan adopted a Perchlorate Action Plan. Objectives include expanded monitoring and reporting programs and continued tracking of remediation efforts in the Las Vegas Wash. Metropolitan has been conducting monthly monitoring of Colorado River supplies. The source of the perchlorate that originates in the Las Vegas Wash is most likely from a chemical manufacturing site located in Henderson, Nevada. The Nevada Department of Environmental Protection manages a comprehensive groundwater remediation program in the Henderson area. As of December 2004, the amount of perchlorate entering the Colorado River system from Henderson has been reduced from approximately 1,000 pounds per day (lb/day) to less than 90 lb/day.

Uranium

Naturally occurring uranium has always been present in Colorado River water and has always been under the California Maximum Contaminant Level (MCL) of 20 picocuries per liter (pCi/l). The risks to water quality have primarily come from upstream mining in Moab, Utah and other potential mining sites in the west. Currently the U.S. Department of Energy (DOE) is working to remove and dispose of mine tailings and improve groundwater quality on the Colorado River Watershed near Moab. The expected completion of this cleanup is between 2019 and 2025. Current levels are below MCL and can be treated by regional water treatment plants.

Nutrients

The Colorado River system has historically been low in nutrients, but with population growth in the watershed nutrients are still a concern. Metropolitan is involved with upstream entities along the lower Colorado River to enhance wastewater management to control nutrient loading, especially phosphorus. The Colorado River's low nutrient level has been important for blending with SWP water to reduce the nutrient level delivered to retail agencies.

Arsenic

Arsenic is another naturally occurring element that is being monitored by drinking water agencies. The state detection level for purposes of reporting is 2 micrograms per liter (jg/l), and the MCL for domestic water supplies is 10 |jg/l. Between 2001 and 2008, arsenic levels in Colorado River water have ranged from not detected to 3.5 jg/l. Increasing coagulant doses at water treatment plants can reduce arsenic levels for retail deliveries

10.2.2 State Water Project (SWP)

The quality of SWP water as a drinking water source is affected by a number of factors, most notably seawater intrusion and agricultural drainage from peat soil islands in the Delta. SWP water contains relatively high levels of bromide and total organic carbon, two elements that are of particular concern to drinking water agencies. Bromide and total organic carbon combine with chemicals used in the water treatment process to form disinfection byproducts that are regulated under the federal Safe Drinking Water Act (SDWA). Wastewater discharges from cities and towns surrounding the Delta also add salts and pathogens to Delta water, and they influence its suitability for drinking and recycling.

The 2000 Record of Decision (ROD) adopted by CALFED states that CALFED will either achieve water quality targets at Clifton Court Forebay and drinking water intakes in the south and central Delta, or it will achieve an “equivalent level of public health protection using a cost-effective combination of alternative source waters, source control, and treatment technologies.”

Actions to protect Delta fisheries have exacerbated existing water quality problems by forcing the SWP to shift its diversions from the springtime to the fall, when salinity and bromide levels are higher. Closure of the Delta Cross Channel gates to protect migrating fish has also degraded SWP water quality by reducing the flow of higher quality Sacramento River water to the SWP pumps at critical times. The Bay Delta Conservation Plan (BDCP) and its successor California WaterFix and EcoRestore are intended to address these problems and improve water quality in the delta and SWP supplies. The Final Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) is expected to be released and certified in 2016.

Total Organic Carbon and Bromide

Total organic carbon and bromide are naturally occurring but are elevated due to agricultural drainage and seawater intrusion as water moves through the delta. The concern with both total organic carbon and bromide is that they form disinfection byproducts (DBPs) when treated with disinfectants such as chlorine. Some DBPs have been identified and are regulated under SDWA; there are others that are not yet identified. The potential adverse health effects may not be fully understood, but associations with certain cancers, reproductive and developmental effects are of significant concern. Water agencies began complying with new regulation to protect against the risk of DBP exposure in January 2002 under the Disinfection Byproducts (D/DBP) rule Stage 1. The U. S. Environmental Protection Agency (EPA) promulgated the Stage 2 D/DBP rule in January 2006, which has made compliance more challenging. The BDCP and its successor California WaterFix and EcoRestore have outlined a wide array of actions to improve Bay-Delta water quality, which remains the best method for controlling these elements of concern in the drinking water supply.

Nutrients

SWP supplies have significantly higher nutrient levels over the Colorado River supplies. Elevated levels of nutrients can increase nuisance algal and aquatic weed growth, which in turn affects taste and odor in product water and can reduce filter run times at WTPs. Nutrient rich soils in the Delta, agricultural drainage, and wastewater discharges are primary sources of nutrient loading to the SWP. Water agencies receiving delta water have been engaged in efforts to minimize the effects of nutrient loading from Delta wastewater plants. Taste and odor complaints due to Delta nutrients are dependent on the blend of imported water delivered through Metropolitan. Metropolitan developed a program to provide early warning of algae-related problems, taste, and odor events to best mange water quality in the system.

Salinity

Water supplies from the SWP have significantly lower TDS levels than the Colorado River, averaging 250 mg/l in water supplied through the East Branch and 325 mg/l on the West Branch. Because of this lower salinity, Metropolitan blends SWP water with high salinity CRA water to reduce the salinity levels of delivered water. However, both the supply and the TDS levels of SWP water can vary significantly in response to hydrologic conditions in the Sacramento-San Joaquin watersheds.

The TDS levels of SWP water can also vary widely over short periods of time. These variations reflect seasonal and tidal flow patterns, and they pose an additional problem to blending as a management tool to lower the higher TDS from the CRA supply. For example, in the 1977 drought, the salinity of SWP water reaching Metropolitan increased to 430 mg/l, and supplies became limited. During this same event, salinity at the Banks pumping plant exceeded 700 mg/l. Under similar circumstances, MWD's 500 mg/l salinity objectives could only be achieved by reducing imported water from the CRA. Thus, it may not be possible to maintain both salinity standards and water supply reliability unless salinity levels of source supplies can be reduced.

The BDCP Draft EIR/EIS identified targets that are consistent with TDS objectives under targets MWD has set for drinking water quality, which states its need "to meet Metropolitan's 500 mg/l salinity-by blending objective in a cost-effective manner while minimizing resource losses and ensuring the viability of recycling and groundwater management programs."

Arsenic

Arsenic levels in SWP water have ranged from not detected to 4.0 pg/l. Increasing coagulant doses at water treatment plants can reduce arsenic levels for retail deliveries. Groundwater storage programs in the SWP appear to provide the greatest risk of arsenic contamination; therefore, a pilot arsenic treatment facility is being tested by one of the groundwater partners. vulnerable to a number of contributors to water quality degradation.

10.2.3 Local Surface Water

Regional surface and groundwater are primarily vulnerable to increasing urbanization in the watershed, agriculture, recreational uses, wildlife, and fires. The Regional Water Quality Control Board's Basin Plan for the San Diego region designates beneficial uses for streamflow and surface waters, coastal waters, and reservoir and lake resources within the Region's 11 watersheds. The Basin Plan also designates wildlife habitat, water contact recreation, and non-contact recreation of surface waters as beneficial uses within each of the watersheds. Additionally, portions of each of the 11 watersheds in the region have been designated as warm-water or cold- water aquatic habitats. Municipal, agricultural, and industrial supplies are designated as beneficial uses of surface waters within 10 of the 11 watersheds.

10.2.3.1 Surface Water Quality Standards

The Basin Plan (RWQCB, 1994) establishes numeric and narrative water quality objectives to protect designated beneficial uses of inland surface waters and coastal waters. The Basin Plan establishes numeric water quality objectives for TDS, mineral constituents, and turbidity on a watershed-by-watershed basis within the Region. The Water Quality Objective for TDS for surface waters is set at 500 mg/L (the state and federal secondary drinking water standard) in most watersheds, but TDS objectives range from as low as 300 mg/L in the upper reaches of the San Diego River Watershed to as high as 2,100 mg/L in the downstream reach of the Tijuana River Watershed.

Water quality objectives that apply to the entire region are established for total and fecal coliform bacteria, nutrients (total nitrogen and total phosphorus), pH, dissolved oxygen, and unionized ammonia. The Basin Plan establishes a region-wide phosphorus standard of 0.025 mg/L for standing bodies of water, and a phosphorus standard of 0.05 mg/L for flowing waters. A narrative objective for biostimulatory substances defines total nitrogen standards at a 10:1 ratio to the total phosphorus limits; however, as indicated above, the Regional Board currently interprets these narrative objectives as numerical concentration standards.

Water quality objectives for toxic organic and toxic inorganic constituents are established at the corresponding state and federal drinking water standards for waters designated as municipal supply. The Regional Board also implements the Water Quality Criteria for Priority Toxic Pollutants for California Inland Surface Waters, Enclosed Bays and Estuaries, also known as the California Toxics Rule (CTR) established by the U.S. Environmental Protection Agency in Title 40 §141.38 of the Code of Federal Regulations. The CTR establishes numeric criteria for cyanide, metals, and toxic organic constituents (EPA, 2002).

The SWRCB established water quality objectives for ocean waters in the Water Quality Control Plan for Ocean Waters of California (Ocean Plan). The Ocean Plan establishes receiving water standards for total coliform, fecal coliform, toxic inorganic constituents, and toxic organic constituents.

In addition to complying with statewide regulations, the Region has recognized the need to improve surface water quality, especially within the Region's reservoirs given the important role that those reservoirs play in regional water supply reliability. To address the issues associated with surface water quality, the SDCWA, the city of San Diego, and the county of San Diego have formed a Regional Water Management Group (RWMG) to coordinate development of an Integrated Regional Water

Management program (IRWM) for the San Diego region. An important element in the IRWM is to protect and enhance the region's local surface water quality. As part of this process, projects will be identified and implemented to assist in watershed protection, and thereby, protect the quality of surface water supplies.

One of the key objectives of the IRWM is to reduce sources of pollutants and environmental stressors. This objective targets water management strategies that directly address pollution management and include: agricultural land stewardship, pollution prevention, urban land use planning, urban runoff management, and watershed management and planning. The IRWM stresses the need to attain the region's water quality standards by managing runoff from all sources within the region through the watershed management framework. Due to its concern for the water quality of its reservoirs, the City of San Diego prepared the Source Water Protection Guidelines for New Developments (Guidelines) in 2004. The Guidelines were prepared to assist municipal agencies, designers, land planners, developers, and laypersons in conducting site design planning and select best management practices (BMPs) that protect or improve the quality of runoff draining into the reservoirs. The Guidelines provide a stepwise, simplified BMP selection process to ensure that preferred source water protection BMPs are considered when designing new developments.

Although the use of the Guidelines is voluntary, the guidance is consistent with state and local storm water permit requirements, as well as local planning protocols.

10.2.3.2 Surface Water Reservoir Quality

Within the RAWMP plan area there are several surface water reservoirs that impound local runoff. These reservoirs are located in three watersheds, San Dieguito, San Luis Rey and Santa Margarita. Local surface water treatment plants were constructed by the owners of these reservoirs to treat local runoff although these plants are also connected to the imported water conveyance system since local runoff can be intermittent. TDS of runoff impounded in these reservoirs is lower than imported water and can range between 200-300 mg/l. Turbidity and Total Organic Carbon can increase substantially during high runoff events and during these periods tend to be higher than imported water. Sources and activities that can impair reservoir quality include urban runoff, agricultural runoff, domestic animals and livestock orchards, and septic systems Some of the water quality parameters that local surface water agencies manage are color, manganese, nitrogen, pH, phosphorus, turbidity; sediment, and trace metals.

Eutrophication and algal blooms can occur at local drinking water reservoirs caused by impoundments of local water or conveyed imported water.

The owners of these reservoirs implement active watershed protection measures to meet Basin Plan Standards and address water quality issues at their respective treatment plants as they comply with Safe Drinking Water Act requirements.

10.2.3.3 Section 303(d) Listed Waters

Per Section 303(d) of the Clean Water Act, the Regional Board and State Board are required to identify waters that do not meet applicable water quality objectives. Waters not attaining applicable water quality objectives are deemed to be “impaired” water bodies.

There are 72 inland surface water bodies are currently designated as not attaining applicable water quality objectives (Regional Board, 2009a; State Board, 2010). 303(d)-listed impaired inland surface waters are found in each of the Region's 11 watersheds.

10.3 Groundwater Quality

10.3.1 Designated Beneficial Uses

The Basin Plan designates beneficial uses for groundwater within each hydrologic area of the Region's eleven watersheds. Appendix 3-A presents beneficial uses for groundwater designated in the Basin Plan.

The Basin Plan designates municipal supply, agricultural supply, and industrial service supply as beneficial uses within a significant majority of the Region's hydrologic areas. Industrial process supplies and fresh water replenishment (maintaining surface flows) are listed as beneficial uses within several of the Region's hydrologic areas. The Basin Plan does not designate wildlife habitat as a beneficial use of groundwater, but significant areas of riparian habitat and groundwater- dependent vegetation exist within each of the eleven watersheds.

10.3.2 Groundwater Quality Objectives

The Basin Plan establishes numerical groundwater quality objectives on a watershed-by-watershed basis for color, turbidity, detergent (methylene blue active substances, or MBAS), TDS, and mineral constituents. Additionally, the Basin Plan imposes state and federal drinking water standards for toxic inorganic and toxic organic constituents on groundwater designated for domestic use.

Groundwater quality objectives for TDS and mineral constituents are established as lower concentrations in the upstream portions of the watersheds and at higher concentrations in downstream portions of the watersheds.

10.3.3 Regional Constituents of Concern

While alluvial groundwater aquifers can be quickly recharged by stormwater or urban runoff, the porous nature of the aquifers render them susceptible to contamination by activities on the ground surface, contaminated stormwater infiltration, abandoned well heads, and from underground storage tanks.

Table 10-1 summarizes key groundwater quality issues within the Region. Constituents of concern within Region's groundwater aquifers include TDS, nitrate, iron and manganese, and toxic organic pollutants.

Total Dissolved Solids (TDS).

TDS can affect both the usability of groundwater as a domestic water source and as an irrigation water source. Common areas with elevated concentrations of TDS in the County are found in coastal sedimentary formations and deeper connate water found in desert basins.

Groundwater TDS concentrations within coastal groundwater basins vary significantly, but have generally exhibited a trend of deteriorating water quality in recent decades as a result of seawater intrusion and salt load imbalances associated with imported water use (Water Authority, 1997). Coastal alluvial groundwater aquifers in the region that have experienced significant degradation from elevated TDS concentrations include the Lower Santa Margarita River Basin, Mission Basin (lower San Luis Rey Basin), Lower San Dieguito River Valley, Mission Valley (lower San Diego River Basin), Lower Sweetwater River Valley, and Lower Tijuana River Valley. Groundwater TDS concentrations in these coastal alluvial aquifers currently range from approximately 750 mg/l to more than 2000 mg/l.

Among the principal alluvial groundwater aquifers within the Region, only the Pala/Pauma Basin, Warner Basin, and the upstream portions of the San Pasqual, El Monte, and Middle Sweetwater Basins contain groundwater TDS concentrations below the 500 mg/L state and federal secondary (non-enforceable) drinking water limits for TDS. Water quality in the San Diego Formation (a deep consolidated sediments aquifer that underlies a central portion of the City of San Diego) is highly variable. Groundwater TDS concentrations in this aquifer may range from below 500 mg/L to more than 12,000 mg/L. Groundwater TDS concentrations within inland fractured rock aquifers are variable, but most wells produce groundwater that contains TDS concentrations that are suitable for potable water uses.

Nitrate

State and federal primary (enforceable) drinking water MCLs for nitrate are established at 10 mg/L (as nitrogen). The Basin Plan establishes more stringent nitrate objectives (as low as 2.2 mg/L as nitrogen) for many of the Region's groundwater basins. Alluvial aquifers are susceptible to nitrate contamination from fertilizer application, animal confinement, wastewater percolation, and septic tank discharges. Exceedance of the Basin Plan nitrate objectives has been documented in portions of the San Luis Rey River and San Dieguito River Watersheds (Water Authority, 1997). Potential nitrate problem areas included in the RAWMP study area include portions of the communities of Rainbow, Valley Center, Ramona, Escondido, and San Marcos.

Iron and Manganese

Iron and manganese occur naturally in Region's alluvial groundwater. Groundwater from the Region's coastal aquifers periodically exceeds recommended state and federal secondary (non-enforceable) drinking water standards (0.3 mg/L for iron and 0.05 mg/L for manganese). Aquifers that have exhibited iron and manganese compliance problems include portions of the Santa Margarita River, San Luis Rey River, San Dieguito River, and San Diego River Watersheds (Water Authority, 1997).

Toxic Organic Compounds

Several toxic organic compounds have been detected in groundwater within several of the Region's aquifers. Underground fuel tanks are a common source of groundwater contamination that may result in noncompliance with state and federal drinking water limits for benzene, methyl-tertiary-butyl ether (MTBE), and other volatile organic compounds. MTBE, in particular, is a key contaminant due to its low State of California primary MCL of 5 micrograms per liter (gg/L) and its ability to be rapidly dispersed by diffusion and advection throughout an aquifer. The State Board's Geotracker database system lists more than 100 sites of documented leaking underground fuel tanks within the Region's eleven watersheds. Although contamination effects from most of these sites are localized, a mile-long plume of petroleum derivatives from the Mission Valley Terminal (a fuel storage facility) contaminates portions of the Mission Valley aquifer in the San Diego River Watershed. The Mission Valley Terminal is under a Regional Board Order to reduce concentrations of dissolved phase petroleum hydrocarbon constituents to attain background water quality conditions by December 31, 2013.

In February 2009, the State Board adopted Resolution No. 2009-011, which established a statewide Recycled Water Policy. The Recycled Water Policy requires the State Board and the Regional Boards to exercise their authority to the fullest extent possible to encourage the use of recycled water, consistent with state and federal water quality regulations. The Recycled Water Policy identifies Integrated Regional Water Management stakeholder-driven salinity/nutrient management plans (SNMPs) as the appropriate means for identifying and managing salinity and nutrient loads associated with recycled water use.

Table 10-1 Water Quality Constituents of Concern

HU[2]	Watershed	HA[2]	Name of Aquifer	TDS Concentration Range (mg/l)	Water Quality Constituents of Concern[3]			
					TDS	Nitrate	Iron & Manganes	Toxic Organics
901	San Juan	901.4	San Mateo	400 - 800	•	•		•
		901.5	San Onofre	600 - 1500	•	•		•
902	Santa Margarita	902.00	Lower Santa Margarita[4]	600 - 750			•	•
903	San Luis Rey River	903.1	Mission	500 - 2000	•		•	•
			Bonsall	600 - 3400	•	•		
			Moosa Canyon	200 - 900	•	•		
		903.2	Pala/Pauma	350 - 1400	•	•		
		903.3	Warner	250 - 350				
905	San Dieguito River	905.1	Lower San Dieguito	1000 - 27,000	•		•	
		905.3	San Pasqual	320 - 2500	•	•		
		905.4	Santa Maria	500 - 1500	•	•		
907	San Diego River	907.1	Mission Valley	1000 - 3000	•		•	•
			Santee/El Monte	500 - 3000	•		•	
909	Sweetwater	909.1	Lower Sweetwater	1700 - 3100	•			
		909.2	Middle Sweetwater	300 - 1400	•			
911	Tijuana River	911.1	Lower Tijuana	500 - 3000	•			
	Pueblo	908.00						
Vary	Sweetwater Otay Tijuana	909.00 910.00 911.0	San Diego Formation	340 - 12,000	•			

Source: San Diego RWMG 2013 Integrated Water Management Plan

10.4 Desalinated Water Quality

Desalinated seawater supply from the Carlsbad Desalination Plant is to be blended into the Water Authority's aqueduct system. Concentrations of dissolved minerals are low in desalinated product water. To prevent corrosive effects associated with these low concentrations of alkalinity and dissolved minerals, product water from the Carlsbad Desalination Plant will be stabilized prior to blending into the Water Authority aqueducts. After product water stabilization, TDS concentrations in the desalination supply are projected to average approximately 350 mg/L. Table 10-2 summarizes projected quality of the desalination supply from the Carlsbad Desalination Plant.

Table 10-2 Quality of Seawater Desalination Supply

Parameter	Projected Desalination Water Quality Carlsbad	
	Central Tendency[1] (not to be exceeded more than 50% of the time)	Extreme Value[1] (not to be exceeded more than 10% of the time)
Total dissolved solids	350 mg/l	400 mg/l
Boron	0.75 mg/l	1.0 mg/l
Bromide	0.5 mg/l	0.8 mg/l
Chloride	180 mg/l	210 mg/l
Turbidity	0.3 NTU[2]	0.5 NTU[2]

10.5 Recycled Water Quality

Water quality, as it pertains to high salinity supplies, is a significant implementation issue for recycled water projects. High TDS source water poses a special problem for water recycling facilities because conventional treatment processes are designed to remove suspended particles, but not dissolved particles. TDS removal, or demineralization, requires an advanced treatment process, which can increase project costs significantly.

Residential use of water typically adds 200 to 300 mg/l of TDS to the wastewater stream. Self-regenerating water softeners can add another pound of salt per day per unit. Infiltration of brackish groundwater into sewer lines can also cause an increase in TDS.

If an area receives a water supply with TDS of more than 700 mg/l, and residents add 300 mg/l or more through normal use, the recycling facility will produce recycled water with a TDS concentration of 1,000 mg/l or higher. Figure 7-1 shows the average TDS at several of the existing and projected water recycling treatment plants.

In general, TDS concentrations over 1,000 mg/l become problematic for irrigation and industrial reuse customers. This problem greatly limits the potential uses and marketability of recycled water, particularly for agricultural purposes, because certain crops and nursery stock are sensitive to irrigation water with TDS levels exceeding 1,000 mg/l. Because of the higher salinity of imported water Avocados in particular require additional application of leaching water to control salt build up in the root zone. This has made the application of even higher salinity recycled water a challenge for agriculture in the region. Unfortunately, because of the toxicity of chloride specifically to avocado, there may still be a significant yield reduction, as evidenced by the results from past recycled water trials conducted in cooperation by the University of California Cooperative Extension.

SOURCES

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWM*P). June

San Diego County Regional Water Management Group (RWMG). *Integrated Regional Water Management Plan (2013)*

http://www.projectcleanwater.org *Watershed, San Dieguito, San Luis Rey, Santa Margarita*

San Diego County. 2011. *General Plan Update Final EIR*. August

San Diego County Water Authority, Valley Center Municipal Water District, Mission Resource Conservation District 2001, *Agricultural Water Management Plan*

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11. Climate Change

Regional Planning

Draft San Diego Regional Agricultural Water Management Plan: Part I

11 Climate Change

11.1 Overview

In Chapter 5 of its 2013 update to the California Water Plan (CWP), *Managing Uncertainty*, DWR noted that a new approach to water resources planning required anticipating change to effectively manage uncertainty and risk and be positioned to achieve sustainability in water supply and water resource management. Specifically, as it relates to Climate Change, DWR continued to focus on adaptation as "the changing climate presents many uncertainties in the magnitude, pattern, and the rate of potential change" The 2013 CWP described the following factors:

- *Snowpack*. California's snowpack, a major part of annual water storage, is decreasing with increasing winter temperatures.
- *Hydrologic Pattern*. Warmer temperatures and decreasing snowpack cause more winter runoff and less spring/ summer runoff.
- *Rainfall Intensity*. Regional precipitation changes remain difficult to determine, but larger precipitation events could be expected with warmer temperatures in some regions.
- *Sea Level Rise*. Sea level rise is increasing the threat of coastal flooding, salt water intrusion, and even disruption of water exports from the Sacramento-San Joaquin Delta (Delta) should levees fail on key islands and tracts.
- *Water Demand*. Plant evapotranspiration increases with increased temperature.
- *Aquatic Life*. Higher water temperatures are expected to have a negative effect on some species and may benefit species that compete with native species.
- *Greenhouse Gas Emissions* Carbon Intensity or Carbon Footprint. Storage, transport, and treatment of water involves substantial amounts of energy, which in most cases result in the release of greenhouse gas emissions that contribute to climate change. Each water management strategy should be evaluated for its contribution to the accumulation of greenhouse gasses in our atmosphere

DWR has also identified the need to plan around varying scenarios that prepare for a variety of uncertain future outcomes that will affect water supply availability. An approach SDCWA took in its 2010 UWMP. Regardless of the projected altered conditions, improving local stewardship of the Region's water resources will likely improve the Region's ability to more robustly deal with changed climatic conditions.

11.2 San Diego Region's Response to Climate Change

Climate change has become an increasingly important issue to water utilities and both the state and federal legislators. Changes in weather patterns which deviate from historical cycles could significantly affect water supply planning. The San Diego region recognizes the importance of adapting to climate change and being a leader in sustainability and stewardship.

When evaluating the effects of climate change on long-term water supply planning, a distinction should be made between climate and weather. Weather consists of the short-term (minutes to months) changes in the atmosphere. Climate is how the atmosphere "behaves" over relatively long periods of time. The term climate change refers to changes in long-term averages of daily weather. Changes to climate will be gradual, providing water supply agencies the ability to adapt planning strategies to manage for the supply uncertainties. The effect on supply would be gradual and captured in each five-year update to the UWMP.

Researchers have concluded that increasing atmospheric concentrations of greenhouse gases, such as carbon dioxide, are causing the Earth's air temperature to rise. While uncertainties remain regarding the exact timing, magnitude, and regional impacts of the temperature and potential precipitation changes due to climate change, researchers have identified several areas of concern that could influence long-term water supply reliability. These potential areas are listed below:

Loss of Natural Snowpack Storage

Rising temperatures reduce snowpack in the Sierra Nevada because more precipitation falls as rain, and snowmelt occurs sooner. Snowpack in the Sierra Nevada is the primary source of supply for the State Water Project. Snowpack is often considered a large surface "reservoir," where water is slowly released between April and July each year. Much of the state's water infrastructure was designed to capture the slow spring runoff and deliver it during the drier summer and fall months. The California Department of Water Resources projects that by the end of this century, the Sierra snowpack is projected to experience a 48 to 65 percent loss from its average at the end of the previous century (1961-1990 average).

Sea Level Rise

Rising sea levels could increase the risk of damage to water and water recycling facilities from storms, high-tide events, and erosion of levees. A potential catastrophic levee failure in the Delta could interrupt supplies from the State Water Project, potentially reducing supply deliveries to the San Diego region from Metropolitan. In addition, rising sea levels could cause saltwater intrusion into the Delta, degrading drinking water quality. More freshwater releases from upstream reservoirs would be required to repel the sea to maintain salinity levels for municipal, industrial, and agricultural uses.

Changes in Average Precipitation and Runoff Volume

The effect of climate change on overall precipitation and runoff volumes is still unclear and highly uncertain. For example, a number of studies conclude that the flow of the Colorado River may be reduced by climate change, but a wide disparity exists on the predicted volume. The yield from local surface water resources could potentially be reduced, if annual runoff volumes are reduced due to a decline in precipitation or there is an increase in evapotranspiration in reservoirs. It must be highlighted that research is still highly unclear on how precipitation levels may be impacted by climate change.

Change in Frequency and Intensity of Droughts

Warming temperatures, combined with potential changes in rainfall and runoff patterns, could exacerbate the frequency and intensity of droughts.

Demands Levels

Climate change could also gradually affect water demands out in the future. Warmer temperatures increase evapotranspiration rates and growing season, which are likely to increase outdoor consumptive water use for landscaping. As part of the water demand forecasting effort for the SDCWA's 2010 UWMP, the long-term influence of climate change on demands in the San Diego region was evaluated. The 2010 UWMP discusses climate change and its potential impacts on supply and demand. The main conclusions were that: 1) climate change impacts are not likely to be significant during the 25-year planning period (2010–2035) of the UWMP, and 2) the primary effects of climate change will be experienced as shortages of imported water supply sources and not as significant increases in water demands for either Agricultural or Municipal & Industrial users. The SDCWA plans to again evaluate the long-term influence of climate change on demands in its 2015 UWMP.

Supply Diversification and Adaptation

All five of the areas discussed above focus on the potential effect climate change could have on future supply reliability. The potential long-term effect is a possible decrease in the availability of imported supplies from MWD and local supplies - causing a potential gap between supply and demands. The supply and demand impacts from climate change will just start to be experienced within the 2010 Plan 25-year planning horizon, but should be considered in establishing “no regret” strategies that provide water supply benefits within the planning horizon, while increasing the ability to manage potential climate change impacts in the future. The foundational strategy to diversify the region's resource mix through development of local projects, such as recycled water and seawater desalination, reduces reliance on imported and local surface supplies, whose yields could potentially decrease as a result of climate change, The addition of almost 200,000 acre feet of storage capacity for droughts and emergencies will allow the region to optimize the hydrologic cycle as it varies between normal, wet, and dry years and to store water earlier in the season as runoff is expected earlier in the year than what is now experienced.

11.3 Partnerships in Research

SDCWA as the region’s wholesale water supplier continues to partner with experts in the field of climate change to ensure the region is able to manage the uncertainties associated with climate change and in coordination with its member agencies continue to provide a reliable supply of water. SDCWA has partnered with the Scripps Institution of Oceanography on research efforts to better understand the uncertainties of climate change and the influence climate change may have on local surface water supplies and demands within the San Diego Region. SDCWA is also currently participating in a San Diego Basin Study, being prepared by the United States Bureau of Reclamation that will assess the potential climate change impacts on water supply and demand in the San Diego region. The City of San Diego is a partner in funding the study and serves as the local project lead. In addition, as a founding member of the Water Utility Climate Alliance, SDCWA coordinates with water utilities across the nation to enhance climate change research and improve water management decision-making to ensure that water utilities will be positioned to respond to climate change and protect water supplies.

11.4 Conclusions on Climate Change

Continuing to support practical research, planning for the development of reliable local supplies independent of the hydrologic cycle, using storage to manage the more extreme variations in surface water runoff and aggressive conservation result in an effective strategy to adapt to and manage climate change in the region.

Sources

San Diego County Water Authority (SDCWA). 2011. *2010 Urban Water Management Plan (UWM*P). June

California Department of Water Resources. 2013. *California Water Plan Volume 1 -The Strategic Plan, Chapter 5, Managing an Uncertain Future*

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12. Water Use Efficiency

Regional Planning

Draft San Diego Regional Agricultural Water Management Plan: Part I

12 Water Use Efficiency Information

12.1 Legislative Requirements

Water Code §10826 (e) requires that certain water use efficiency information be included in the AWMP per §10608.48. Sections 10608.48 (a) through 10608.48(f) are related to the EWMPs of the AWMP. Sections 10608.48 (a) to 10608.48 (c) require implementation of EWMPs. Section 10608.48 (d) requires a report of which EWMPs have been implemented, an estimate of efficiency improvements, and documentation that non-implemented EWMPs were either not locally cost-effective or technically feasible. Section 10608.48 (e) specifies how to report the information.

Implementation of critical EWMPs (Water Code §10608.48 (b)) are required of all agricultural water suppliers. Other EWMPs (Conditional), listed in Water Code §10608.48 (c), are required only if they are locally cost-effective and technically feasible. This section lists the AWMP reporting requirements and EWMPs implementation requirements. DWR also encourages the agricultural water supplier to report on how implementation of EWMPs may have affected or is anticipated to affect operations.

12.2 San Diego Regional Agricultural Water Use Efficiency

The Water Authority, its member agencies, and the San Diego Farm Bureau (Farm Bureau) have provided technical and financial support for agricultural water use efficiency (WUE) in the San Diego Region since the 1980’s. Water suppliers, like Valley Center Municipal Water District (VCMWD,) funded WUE programs prior to implementation of the regional approach. Most of those programs have been implemented by the Mission Resource Conservation District (MRCD) and funded by the San Diego County Water Authority (SDCWA).

MRCD has been under contract to the SDCWA to operate agricultural water management services since 1990 as part of the Water Authority's AWMP. During that time, MRCD provided more than 1,700 audits on more than 28,000 acres of avocados, citrus, field flowers, and other fruits and ornamentals. The goal of the program is to provide technical assistance to growers to enable them to irrigate crops as efficiently as possible in order to obtain the maximum economic benefit from limited water resources. The WUE programs have included direct assistance to retail water users, implementation of University of California Cooperative Extension (UCCE) BMPs, funding information assistance, and water purveyor efficiency practices.

This AWMP identifies several previously implemented and ongoing regional water management activities, which include measures financially supported by the water agencies, through the Water Authority, and implemented with assistance from the Farm Bureau and MRCD.

Those include:

a. Direct water management assistance programs including:

- Irrigation system evaluations for growers measuring how efficiently and how accurately water is being applied in relation to the crop water requirements Growers are provided a comprehensive evaluation report and recommendations for improving overall system efficiency as well as a recommended irrigation schedule.
- Assistance in using the California Irrigation Management Information System (CIMIS). Training in using CIMIS data for irrigation scheduling is provided to growers. Additionally, seven day CIMIS reference evaporation (ETo) information for select San Diego County regions is provided on the MRCD web site.
- Free workshops and training addressing a range of issues related to WUE are regularly conducted by MRCD and the Farm Bureau, with support from the water agencies.
- Assistance to growers is provided in implementing the UCCE BMPs that address irrigation runoff from nurseries, orchards, and field operations. The goal of the BMPs is to maximize irrigation efficiency and eliminate nutrients entering surface water. The BMPs consist of twenty-six measures including: irrigational system design and maintenance, irrigation rates and scheduling, and personnel training.

b. Information about financial assistance for implementing WUE measures that may be available through the USDA or others is provided to growers.

c. All agricultural irrigation water used in the region is metered and growers are billed on a commodity use basis.

d. Agricultural water deliveries are made through pressurized mains, eliminating delivery water loss to evaporation.

12.2.1 EWMP Implementation and Reporting

The Water Code requires that the AWMP include:

"...a report on which efficient water management practices have been implemented and are planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future. If an agricultural water supplier determines that an efficient water management practice is not locally cost effective or technically feasible, the supplier shall submit information documenting that determination." (Water Code§10608.48 (d)).

As such, the RAWMP includes:

- A list of implemented and planned-to-be-implemented EWMPs
- An estimate of the water use efficiency improvements since the previous report and estimated to occur in five and ten years. Water use efficiency improvements can be quantitative or descriptive, depending upon the nature of the EWMP and information available to the agricultural water supplier. Additionally, estimating water use efficiency may not be practical or possible for individual EWMPs. In such cases, an overall estimate for multiple EWMPs is advised.

12.2.2 Critical EMWPs

The critical EWMPs must be implemented by the agricultural water supplier (Water Code

§10608.48(b)). These include:

(1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).

(2) Adopt a pricing structure for water customers based at least in part on quantity delivered. Furthermore, the CCR requires water suppliers, as defined in the CCR §597 et seq., to measure water with devices that comply with the accuracy standards of the Agricultural Water Measurement Regulation.

12.2.3 Conditional EWMPs

As noted above, if certain EWMPs are not locally cost-effective or technically feasible they would not have to be implemented. However, if these EWMPs are locally cost-effective and technically feasible, they must be implemented by agriculture water suppliers providing water to at least 25,000 irrigated acres and water suppliers providing water to 10,000 to 25,000 irrigated acres if funding is provided (Water Code §10608.48 (c)). Additionally, the EWMPs that are implemented or planned to be implemented should be reported in the AWMP.

(1) “Facilitation of alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including problem drainage “(Water Code §10608.48 (c)(1)).

(2) “Facilitation of use of available recycled water that otherwise would not be used beneficially, meets health and safety criteria, and does not harm crops or soils. The use of recycled urban wastewater can be an important element in overall water management” (§10608.48 (c)(2)).

(3) “Facilitate the financing of capital improvements for on-farm irrigation systems”

(§10608.48 (c)(3)).

(4) “Implement an incentive pricing structure that promotes one or more of the following goals” (§10608.48 (c)(4)):

A. “More efficient water use at the farm level such that it reduces waste”

(§10608.48 (c)(4)(A)).

B. “Conjunctive use of groundwater” (§10608.48 (c)(4)(B)).

Explanation: In dry years, the water suppliers may encourage, through higher prices

for surface water, pumping more groundwater and leaving surface water for environmental uses.

C. “Appropriate increase of groundwater recharge” (§10608.48 (c)(4)(C)).

Explanation: In wet years, pricing may be used to encourage greater use of surface water to facilitate recharge. For examples, see: interactive case studies database at

http://agwaterstewards.org/

D. “Reduction in problem drainage” (§10608.48 (c)(4)(D)).

For an example, see Red Rock Ranch interactive case studies database at

http://agwaterstewards.org/

E. “Improved management of environmental resources” (§10608.48 (c)(4)(E)).

F. “Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions” (§10608.48 (c)(4)(F)).

(5) “Expand line or pipe distribution systems, construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage”

(§10608.48 (c)(5)).

(6) “Increase flexibility in water ordering by, and delivered to, water customers within operational limits” (§10608.48 (c)(6)).

(7) “Construct and operate supplier spill and tail-water systems” (§10608.48 (c)(7)).

(8) “Increase planned conjunctive use of surface water and groundwater within the supplier service area” (§10608.48 (c)(8)).

(9) “Automate canal control devices” (§10608.48 (c)(9)).

(10) “Facilitate or promote customer pump testing and evaluation” (§10608.48 (c) (10)).

(11) “Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports” (§10608.48 (c) (11)).

(12) “Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following” (§10608.48 (c) (12)):

A. “On-farm irrigation and drainage system evaluations” (§10608.48 (c) (12) (A)).

Eco/mobile labs are programs that evaluate the performance of irrigation systems.

These laboratories measure water application rates and system distribution uniformity and give recommendations for irrigation system improvement.

B. “Normal year and real-time irrigation scheduling and crop evapotranspiration information” (§10608.48 (c)(12) (B)).

An important source of ET data for California is the California Irrigation

Management Information System (CIMIS). CIMIS is a network of over 140 automated weather stations scattered throughout California that provide ETo and weather data to the public free of charge: http://www.cimis.water.ca.gov/cimis/welcome.jsp

C. “Surface water, groundwater, and drainage water quantity and quality data”

(§10608.48 (c) (12) (C)).

D. “Agricultural water management educational programs and materials for farmers, staff, and the public” (§10608.48 (c) (12) (D)).

These could include such items as: soil moisture and salinity monitoring, in-school awareness programs, budgeting software, efficient irrigation techniques, crop water budget and other approaches, program delivery via workshops, seminars, newsletters, field days and demonstration, and others.

(13) "Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional change to allow more flexible water deliveries and storage."

(§10608.48 (c) (13)).

(14) "Evaluate and improve the efficiencies of the supplier's pumps." (§10608.48 (c) (14)).

See Table 13.A.1 Report of EWMPs Implemented/Planned, for status of each EWMP.

See Table 13.A.2 Report on EWMPs Efficiency Improvements, for estimates of future regional water use efficiency improvements.

12.2.4 Documentation for Non-Implemented EWMPs

For Conditional EWMPs, the EWMP reporting in the AWMP includes documentation of the agricultural water supplier's determination that a conditional EWMP is not locally cost-effective or technically feasible, if applicable (Water Code §10608.48 (d)). Locally cost effective is defined in the Water Code as:

> "Locally cost effective" means that the present value of the local benefits of implementing an agricultural efficiency water management practice is greater than or equal to the present value of the local cost of implementing that measure." (Water Code §10608.12 (k))

The Water Code requires that critical EWMPs be implemented. Conditional EWMPs may be omitted if they are not locally cost-effective or technically feasible; however, documentation in the AWMP for this determination is required for compliance with the Water Code.

All critical and conditional EWMPs have been implemented in the San Diego Region.

Finally, continued implementation of the EWMPs and the resulting water use efficiency should result in operational benefits for water suppliers by reducing water demand peaking and water treatment costs.

Table 12-1 Report of EWMPs Implemented/Planned (Water Code §10608.48(d), §10608.48 (e), and §10826 (e))

EWMP No.	Description of EWMP Implemented	Description of EWMPs Planned
	Critical EWMPs	
1 - Water Measurement	All agricultural customers in the region receive deliveries through water meters. The retail water agencies suppling those meters regularly test them for accuracy through scheduled maintenance and replacement programs.	No additional actions are planned
2- Volume Based Pricing	All agricultural water customers in the region are charged using volume based pricing	No additional actions are planned
	Conditionally Required EWMPs	
1 - Alternate Land Use	Conversion of agricultural land in the region to alternative uses is taking place and is anticipated to continue as a result of rising property values and urban growth.	No programs to increase alternate land use trends are planned.
2 – Use of Recycled Water	Agricultural water consumers in the region have been using recycled water for irrigating a variety of crops for many years. However, source water quality problems and delivery challenges have limited opportunities.	Increases in the use of recycled water for agricultural proposes in the region are planned.
3 – Financing for on Farm Irrigation Systems	Due to the high cost of water, growers have been self-motivated and it has not been necessary for water agencies to provide financing for on farm irrigation systems. However, the MRCD provides referrals to the USDA Natural Resources Conservation Service for potential funding opportunities.	No additional financing assistance is planned.
4 – Implement a pricing structure to promote: more efficient use, conjunctive use of groundwater, groundwater recharge, reduction in problem drainage, environmental resources, and seasonal pricing.	The current Regional pricing structures, with among the highest commodity charges in the state, send a strong pricing signal to promote very efficient water use and reduce problem drainage. Regional geologic conditions do not make conjunctive use or groundwater recharge feasible. Maintaining and enhancing environmental resources are encouraged through current pricing structures.	Retail commodity water rates are planned to continue to significantly increase, encouraging continued WUE. Seasonal pricing may be considered in future rate setting.
5 – Increasing distribution systems efficiency	All agricultural water deliveries in the region are made through pressurized pipe distribution systems.	No additional actions are planned.
6 – Increasing delivery flexibility	Retail water agencies work closely with growers to assure deliveries are timed to	No additional actions are planned.

	insure both adequate delivery system water pressure and efficiency are maintained.	
7 – Developing spill and tail-water systems	Flood irrigation is not practiced in the region. However, growers are practicing the UCCE BMPs for irrigation to address any minimal irrigation run-off that could occur.	No additional actions are planned.
8 – Conjunctive water use	The regional geology is not conducive to opportunities for conjunctive groundwater use.	No actions are planned.
9 – Canal control devices	No deliveries in the region are made through canals.	No actions are planned.
10 – Customer pumps	The limited groundwater pumping in the region is conducted by individual growers and the water agencies are not involved in that process. However, MRCD provides well water analysis and assistance to those growers.	No additional actions are planned.
11 - Designate Water Conservation Coordinator	Each of the retail water agencies, and the Water Authority, has a water conservation coordinator.	No additional actions are planned.
12 – Provide management services including: irrigation and drainage evaluations, irrigation and ETo information, water quality and quantity data, and education programs and materials	An active regional program has been in place since the 1980's to provide: on- site real time irrigation scheduling and drainage evaluation; irrigation and crop ETo information; water quality information and analysis; soil analysis; and education information, materials, and training workshops, and seminars to growers, staff and the public.	No additional actions are planned.
13 – Identify potential for more flexibility for deliveries and storage	Opportunities for delivery flexibility and storage have been carefully reviewed and maximized.	No additional actions are planned.
14 – Improve efficiency of supplier's pumps	The retail water agencies in the region do not pump any groundwater and all water delivery pumps are maintained to assure efficiency.	No actions are planned.

Table 12-2 Report of EWMPs Efficiency Improvements (Water Code §10608.48(d), §10608.48 (e), and §10826 (e))

Corresponding EWMP No.(s)*	Estimate of Water Use Efficiency Improvements That Occurred Since Last Report (Quantitative or Descriptive) (1)	Estimated Water Use Efficiency Improvements 5 and 10 years in future (Quantitative or Descriptive)
2. Recycled water use 4. Pricing structure to promote efficient use		Regional use of recycled water for agricultural will continue to increase as water quality and distribution issues are resolved. Commodity cost to growers will continue to increase significantly as the cost for imported and local water increases.

(1) There was no regional reporting of water use efficiency improvement in the past, thus this column is left blank.

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