3 Region Description

The San Diego IRWM Region (Region) as defined by this 2019 IRWM Plan consists of eleven parallel and similar watersheds within the County of San Diego that discharge to coastal waters. Figure 3-1 provides an overview of the Region's watersheds and *Chapter 5, Watershed Characterizations* provides a detailed discussion of the water resources within each watershed. The Region boundaries were selected primarily on the basis of water management regulatory and political jurisdictional boundaries. Other factors that influenced IRWM Plan boundary selection included similarities in hydrology and watershed characteristics and a common imported water supply.

3.1 Region Overview

Population

The Region addressed by this 2019 IRWM Plan includes all but a small fraction of the County's population. Table 3-1 presents existing and projected population within the County and Water Authority service area. Table 3-1 also presents a population breakdown by ethnicity and age. Population within the Region is projected to increase by approximately 22% by the year 2040.

Table 3-1 also illustrates that nearly all of the County's population is within the Water Authority service area. The portion of the County's population outside the Water Authority service area is mainly dependent on local groundwater supply.

Social and Cultural Makeup

The Region is culturally diverse and features national and ethnic communities from throughout the world, including large and active national and ethnic communities from Mexico, Central and South America, the Caribbean, Africa, Europe, former Eastern bloc nations, the Middle East, India, China, Southeast Asia, and the Pacific Islands.

As shown in Table 3-1, the Region's diverse ethnic groups comprise a majority of the County's population. Population gains are projected within all ethnic communities.

By numbers, Hispanics represent the fastest growing segment of the population, and currently comprise roughly one-third of the Region's population. The Region also features a diverse Asian population that includes large communities that celebrate heritage from China, Southeast Asia, and India. Pacific Islander populations within the County are projected to show the greatest percentage increase in the next twenty years (SANDAG, 2013).

Figure 3-1: Overview of Region's Watersheds

Source: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
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Table 3-1: Existing and Projected Population

Category	Demographic Parameter	2015[2]	2020	2025	2030	2035	2040
Population (millions)	San Diego County[1]	3,223,096[3]	3,435,713	3,601,158	3,741,666	3,853,698	3,937,280
	Water Authority Service Area[4]	3,146,771	3,340,594	3,495,978	3,630,542	3,745,684	3,825,041
	Percent of San Diego County	97%	97%	97%	97%	97%	97%
San Diego County Population Breakdown by Age[1]	Percent Age 0-19	26%	26%	26%	25%	25%	24%
	Percent Age 20-39	30%	30%	29%	28%	27%	27%
	Percent Age 40-59	25%	24%	23%	23%	24%	24%
	Percent Age 60+	18%	21%	22%	24%	24%	24%
San Diego County Population Breakdown by Ethnicity[1]	Percent White	46%	44%	41%	39%	36%	34%
	Percent Hispanic	34%	36%	38%	40%	41%	43%
	Percent Asian	11%	11%	12%	13%	13%	14%
	Percent Black	4%	4%	4%	4%	4%	4%
	Percent Native American	<1%	<1%	<1%	<1%	<1%	<1%
	Percent Pacific Islander	<1%	<1%	1%	1%	1%	1%
	Percent Other/Mixed	3%	4%	4%	4%	4%	4%

1 From SANDAG *2050 Regional Growth Forecast* (SANDAG, 2013), except 2015 data. Percent values rounded to nearest 1%. Populations that were less than 1% are so indicated.

2 2015 demographic data was estimated based on changes from 2012 to 2020 from SANDAG's *2050 Regional Growth Forecast* (SANDAG, 2013)

3 From 2011-2015 American Community Survey (ACS) (ACS, 2015).

4 From Water Authority *52015 Urban Water Management Plan* (Water Authority, 2016), except 2010 data.

The County includes 18 Tribal Nation Reservations, more than any other county in the United States. Native Americans within the Region comprise four tribal groups: the Luiseño, Cupeño, and Cahuilla groups from North San Diego County, and the Kumeyaay/Diegueño tribal group. Only a small percentage of the Region's Native American population of 17,000 lives within the Tribal Reservation lands (SANDAG, 2010). Tribal nations are detailed further in *Chapter 4, Tribal Nations of San Diego County*.

Table 3-2 summarizes language use within the County. English and Spanish are the dominant languages within the Region. English is the sole language of approximately two-thirds of the population, and nearly a quarter of the population speaks Spanish.

Table 3-2: Culture/Language Use (2016)

Language	Principal Language Spoken at Home	Percent who Speak English Less than "Very Well"
English	62.5%	NA
Spanish	24.7%	9.7%
Other Indo-European	3.2%	0.9%
Asian/Pacific Islander	8.1%	3.7%
Other Languages	1.6%	0.8%
Totals	100%	15%

From 2012-2016 ACS data for people over the age of 5 (ACS, 2016).

Table 3-3 summarizes the range of education within the adult population of the County. Approximately 37% of the adult population has a 4-year college degree, and more than 14% of the population has a graduate degree. Less than 12% of the adult population did not graduate from high school.

Table 3-3: Education (2016)

Highest Level of Education Attained	Percent	Cumulative Percent
Graduate Degree	14.2%	14.2%
Bachelor's Degree	23.0%	37.2%
Associates Degree	8.8%	46.0%
Attended College	22.9%	68.9%
High School Graduation	19.2%	88.1%
Attended High School	6.7%	94.8%
Less than High School	5.2%	-

From 2012-2016 ACS data for adults over the age of 25 (ACS, 2016).

Housing

Table 3-4 summarizes projected housing units and types within the Region. Approximately 60% of the population resides in single-family units, though the percentage of households living in multiple-unit structures is projected to increase in the next 20 years as new housing is increasingly multi-family.

Table 3-4: Existing and Projected Housing[1]

Housing within the County[2]	2012	2030	2050	Change 2012 – 2050	
Occupied Units	1,103,034	1,279,823	1,407,869	304,835	28%
Households in Single Family Units (percent of total)	672,496 (61%)	724,236 (57%)	730,020 (52%)	57,524	9%
Households in Multiple Family Units (percent of total)	391,534 (35%)	519,612 (41%)	645,548 (46%)	254,014	65%
Households in Mobile Homes (percent of total)	39,004 (4%)	35,975 (3%)	32,301 (2%)	-6,703	-17%

1 From San Diego Association of Governments (SANDAG), *2050 Regional Growth Forecast*, Series 13 (SANDAG, 2013).
2 The Region addressed in this IRWM Plan includes all of the Water Authority Service Area and almost all of the County's population. Only a small fraction of the County's population is within the Colorado River watershed and is outside the Region addressed in this IRWM Plan.

Land Use

Figure 3-2 presents land use within the Region. Table 3-5 summarizes existing and projected land use acreages within the County. Significant residential development within the Region is projected to occur within the next 25 years. Approximately 15% of the County is currently classified as vacant developable land. By year 2050, vacant developable land is projected to decrease to 8% of the total San Diego County land. Residential lands within the County are projected to increase by more than 50% by year 2050.

Table 3-5: Existing and Projected Land Use within the County (Acres)

Land Use	Existing (2012)	2020	2035	2050	Change 2012 - 2050	
Residential	340,162	405,264	497,494	531,217	191,055	56%
Institutional	12,568	12,941	13,383	13,717	1,149	9%
Commercial/Industrial/Office	72,871	76,732	80,015	83,950	11,079	15%
Other	88,943	91,706	91,709	91,712	2,769	3%
Parks and Military	222,850	225,489	226,399	226,806	3,956	2%
Agricultural and Extractive	109,490	107,046	105,478	104,931	-4,559	-4%
Undeveloped Land[1]	1,880,068	1,807,774	1,712,475	1,674,618	-205,450	-11%
Total	2,726,952	2,726,952	2,726,953	2,726,951	-1	0%

Sources: SANDAG 2013

1 Undeveloped land includes constrained acres (those that cannot be developed due to geography or land use restrictions [e.g., conservation area]). Constrained acres total 1,455,691.

Agricultural and extractive lands are projected to be reduced by 4% between 2012 and 2050. The agricultural lands shown in Table 3-5 include both irrigated agriculture and non-irrigated (cattle grazing) lands across the entire County, as well as areas designated for extractive uses. Most irrigated agriculture that occurs within the Region is within the Water Authority's service area. As documented within the Water Authority's *2015 Urban Water Management Plan*, agricultural water demands decreased 58% between 2007 and 2015, with an additional 11% reduction projected between 2020 and 2040 (Water Authority, 2016).

The United States military owns more than 6% of the Region's land. Major bases that include significant open space or undeveloped lands include United States Marine Corps (USMC) Camp Pendleton, Fallbrook Naval Weapons Annex, and Miramar Air Station. The military acts as a steward of the open space environment and coordinates with local jurisdictions for watershed planning and environmental protection.

Other large federal land holdings within the Region include recreational lands owned and managed by the United States Bureau of Land Management (BLM) and the United States Forest Service (USFS), including Otay Mountain Wilderness, and California Desert Conservation Area (BLM) and Cleveland National Forest (USFS).

Regional Economy

Table 3-6 summarizes projected jobs within the Region. Employment is forecast to increase by 34% through 2050.

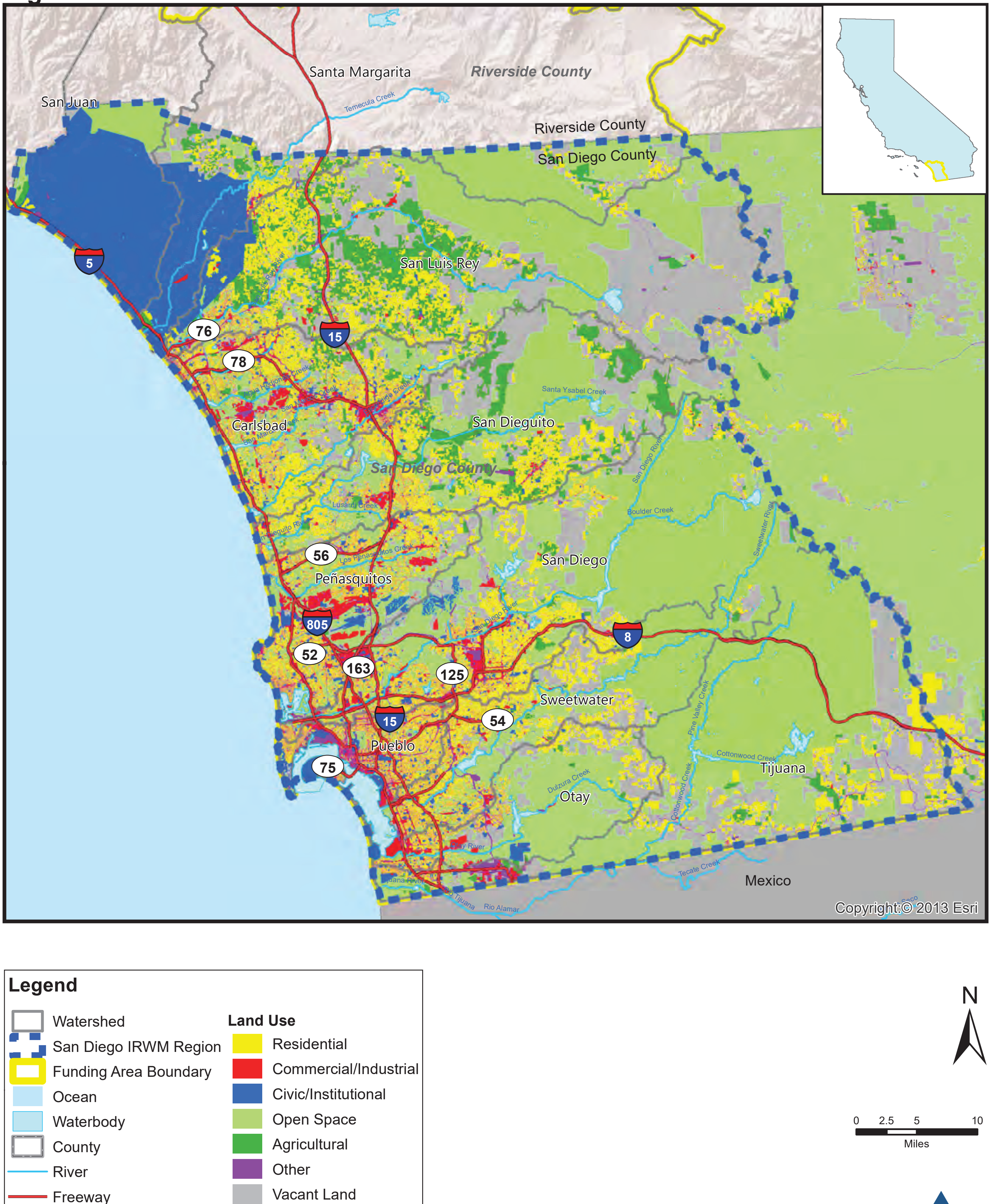
Table 3-6: Existing and Projected Jobs within the County[1]

Jobs within the County[2]	2012	2030	2050	Change 2012 – 2050	
Jobs	1,346,969	1,613,619	1,807,461	460,492	34%

1 From San Diego Association of Governments (SANDAG), *2050 Regional Growth Forecast* (SANDAG, 2013).

2 The Region addressed in this IRWM Plan includes all of the Water Authority Service Area and almost all of the County's population. Only a small fraction of the County's population is within the Colorado River watershed and is outside the Region addressed in this IRWM Plan.

Figure 3-2: Land Use



Source: San Diego Association of Governments (SANDAG) - GIS Data Warehouse Dec 2012
Parks, Cleveland Nat'l Forest, MCSP & MHPA, SANGIS, Available: http://www.sangis.org/Download_GIS_Data.htm
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Table 3-7 summarizes the County's Gross Domestic Product (GDP) for the past five years. The County's GDP exceeded $215 billion during 2016 (U.S. Department of Commerce, 2017). Historically dependent on military spending, the Region's economy has diversified during the past 25 years. The economic recession during 2007 – 2009 resulted in a decline of GDP, but has seen gains since 2010. Manufacturing is the largest economic contributor to the local economy, accounting for $23 billion of the Gross Regional Product. Leading industries within the region include telecommunications, electronics, computers, industrial machinery, aerospace, shipbuilding, biotechnology, and instruments. In 2016, 4,000 tech companies in the region employed 60,800 workers (San Diego Economic Development Corporation, 2017).

Table 3-7: Gross Regional Product within the County

Year	San Diego Region Gross DomesticProduct[1] ($ billions)	Percent Increase from Prior Year
2012	189.33	-
2013	198.5	4.86%
2014	205.11	3.32%
2015	210.77	2.73%
2016	215.3	2.18%

1 GDP data from U.S. Department of Commerce, Bureau of Economic Analysis for the San Diego-Carlsbad Metropolitan Region. All values in current dollars.

Tourism is the second largest industry in the Region. In 2016, tourism had an $18.3 billion impact on the region. Defense represents the third largest industry, and more than a dozen USMC and Navy bases and support facilities exist within the County (San Diego Regional EDC, 2017).

Agriculture ranks as the fourth largest industry in the Region. The 2016 annual crop value within the County (almost all of which is irrigated agriculture) exceeded $1.74 billion. This represents a 2.6% increase from 2015's total of $1.70 billion. Although the value increased, the acreage devoted to commercial agriculture decreased by approximately 0.2% (400 acres) (San Diego County Department of Agricultural Weights and Measures, 2017). The County has the 12th largest agricultural economy in the country (San Diego County Farm Bureau, n.d.a.). With limited precipitation and local water sources, agriculture within the Region is dependent on imported water.

Climate and Precipitation

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. 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 (Water Authority, 2016). Figure 3-3 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.

Significant variation in precipitation also occurs from year to year. Table 3-8 summarizes annual precipitation for a 155-year period at the San Diego Lindbergh Field and City of Escondido precipitation stations. Annual precipitation totals range from more than double the annual mean to less than half the annual mean.

Table 3-8: Annual Variation in Precipitation at San Diego Lindbergh Field, 1850-2012

Parameter		San Diego Lindbergh Field, 1940-2017[1]		Escondido, 1940-2017[2]	
		Annual Precipitation (inches)	Percent of Annual Mean	Annual Precipitation (inches)	Percent of Annual Mean
Maximum Observed Value		24.9	252%	30.7	223%
Percentile Values:	5%	18. 8	190%	25.8	187%
	10%	16.3	165%	24.9	180%
	25%	12.1	114%	17.7	128%
	50%	8.9	90%	12.7	92%
	75%	6.9	70%	9.7	70%
	90%	5.3	53%	5.9	42%
	95%	4.2	43%	2.7	20%
Minimum Observed Value		3.4	35%	0.2	1%
Mean Annual Value		9.8	---	13.8	---

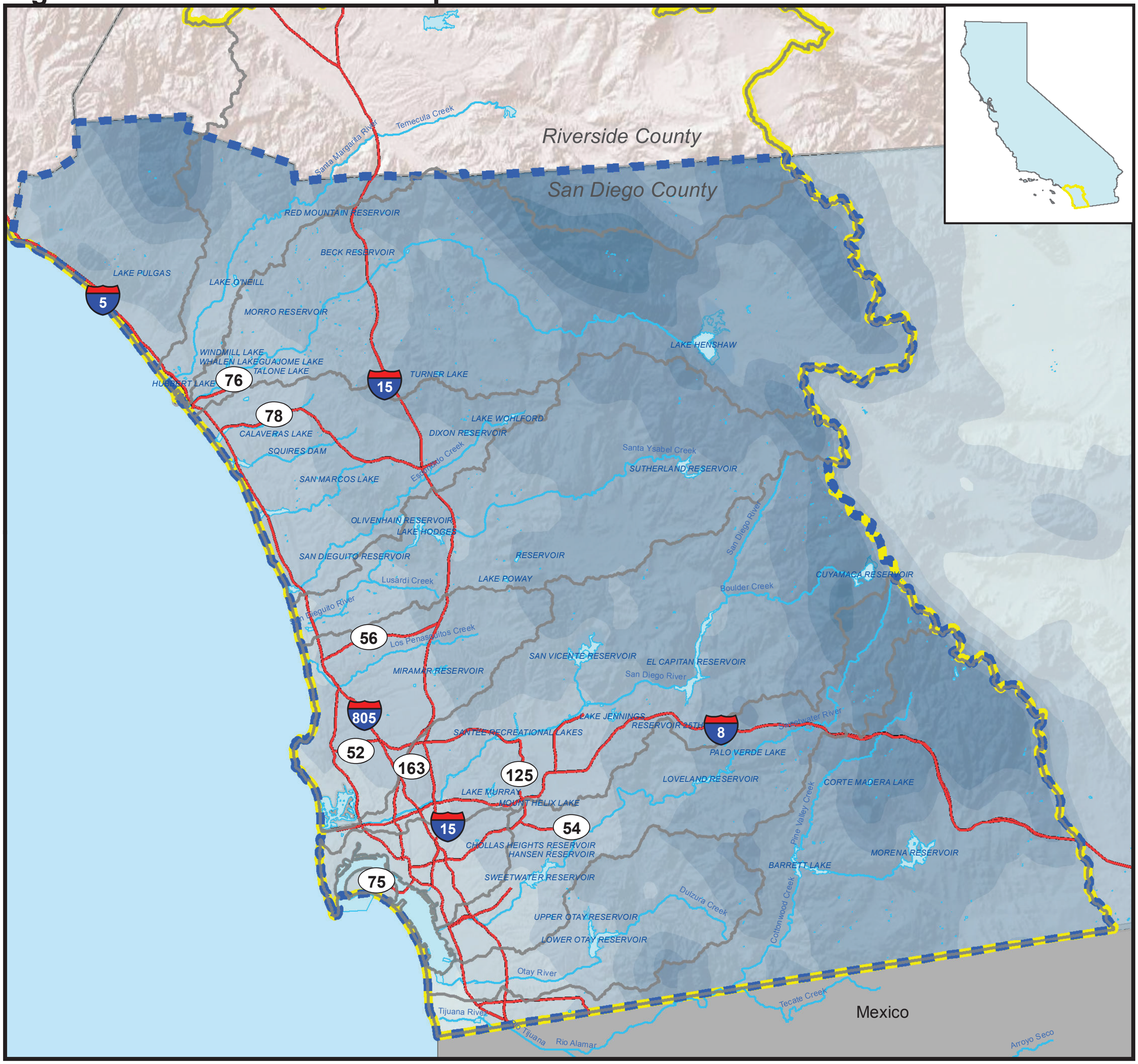
1 Annual calendar year precipitation at San Diego Lindbergh Field (Station 047740) for the period 1940 through 2017. From NOAA Northeast Regional Climate Center (2018).

2 Annual calendar year precipitation at Escondido Station (Station 042863) for the period 1940 through 2017. From NOAA Northeast Regional Climate Center (2013).

While the mean annual precipitation at the Escondido station is 40% greater than at the San Diego Lindbergh Field station, Table 3-8 demonstrates that both stations exhibit a similar statistical distribution about the mean. This is due to the fact that most of the San Diego winter precipitation occurs as a result of eastward-moving frontal storm systems that affect the entire Region. The mean is skewed by a few years of exceptionally high precipitation; as such, precipitation totals above the annual mean occurred only 45% of the time at the two precipitation stations. San Diego Lindbergh Field precipitation was between 6.9 inches (70% of normal) and 12.1 inches (114% of normal) during approximately 50% of the years, while Escondido precipitation was between 9.7 inches (70% of normal) and 17.7 inches (128% of normal) during 50% of the years. For comparison, the South Coast Hydrologic Region, which includes the San Diego IRWM Region north through Los Angeles and Ventura Counties, averages 16.9 inches of precipitation, while the Sacramento River Hydrologic Region, which includes the City of Sacramento, averages over 37 inches per year (DWR, ND).

While all but a fraction of the Region's precipitation occurs during November through April, a significant majority of the potential evaporation (which is approximately equal to the evapotranspiration rate of grass) occurs during summer and autumn months. More than 80% of the potential evaporation occurs during the months of March through October. Potential evaporation within the region ranges from approximately 3.7 feet per year in coastal valleys to more than 4.2 feet per year in inland valleys (DWR, 1986; DWR, 2010). As a result of the effects of climate change, the region may experience longer seasonal dry periods, with spring and fall drier than historically observed (Climate Science Alliance, 2018). Increased dryness is expected to increase evaporation in the region.

Figure 3-3: Mean Annual Precipitation



Legend

- Watershed
- San Diego IRWM Region
- Funding Area Boundary
- Ocean
- Waterbody
- County
- River
- Freeway

Mean Annual Precipitation (in.)

- 3 to 9 inches
- 9 to 12 inches
- 12 to 15 inches
- 15 to 18 inches
- 18 to 21 inches
- 21 to 24 inches
- 24 to 30 inches
- 30 to 35 inches

N

0 2.5 5 10
Miles

Source: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
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3.2 Defining Boundaries for the Region

The San Diego Region as defined by this IRWM Plan consists of eleven parallel and similar watersheds within the County of San Diego that discharge to coastal waters. The regional boundaries were selected primarily on the basis of regulatory, jurisdictional, and political boundaries. Other factors that influenced IRWM Plan boundary selection included similarities in hydrology and watershed characteristics, and a common imported water supply.

Watersheds, Hydrologic Units, Hydrologic Areas, and Watershed Management Areas

A watershed is an area of land that drains downslope to a common point. A hydrologic unit (HU) is a drainage area delineated by DWR that may include one or more individual sub-watersheds. Within this IRWM Plan, 'watershed' refers to HU. An HU is further subdivided into hydrologic areas (HA), each of which may represent one or more sub-watersheds.

The San Diego Region is comprised of eleven westward draining, DWR-designated HUs, four of which (San Juan, Carlsbad, Peñasquitos, and San Diego Bay WMA) are comprised of smaller parallel sub-watersheds that drain to common coastal waters. Seven of the Region's HUs constitute watersheds for the Region's primary rivers: Santa Margarita, San Luis Rey, San Dieguito, San Diego, Sweetwater, Otay, and Tijuana.

The Regional Board defines a watershed management area (WMA) as a drainage area that may include one or more HUs or watersheds. As designated by the Regional Board, three HUs (Pueblo, Sweetwater, and Otay) are combined to form the San Diego Bay WMA. The Peñasquitos HU is composed of the Mission Bay WMA and the Los Peñasquitos WMA. The Region's remaining seven hydrologic units constitute their own individual WMAs.

Appropriateness of Region

The San Diego IRWM Region is appropriate for regional water management. The selected regional boundaries take into account the San Diego Regional Water Quality Control Board (San Diego Water Board) jurisdiction, political jurisdictions, physical and hydrologic characteristics, the imported water supply service area, and wastewater service considerations.

San Diego Regional Water Quality Control Board Jurisdiction

The Region is entirely within the jurisdiction of the San Diego Water Board (designated as Region 9 among California's Regional Water Quality Control Boards). Water quality and wastewater discharges within the Region are regulated by policies and regulations established in the San Diego Water Board's *Water Quality Control Plan for the San Diego Basin* (Basin Plan). Ocean and marine water quality is regulated by policies and regulations established in the Basin Plan (San Diego Water Board, 1994, last updated 2016), Ocean Plan (State Board, 2015), and Enclosed Bays and Estuaries Plan (State Board, 2009).

Municipal stormwater runoff within the Region is regulated through a single National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit issued by the San Diego Water Board to designated Copermittees (refer to *Section 3.6.4* for complete list of Copermittees for the San Diego County area). Two of the three Regional Water Management Group (RWMG) agencies (County of San Diego and City of San Diego) comprise the largest land area among the regulated Copermittees.

The San Diego Water Board's jurisdiction includes the southern portions of Orange and Riverside Counties. The IRWM Plan boundaries, however, are limited to the County of San Diego on the basis of political jurisdictions, development and land use trends, land use regulatory authority, water supply, and stormwater regulation and control (see insert above).

Political Jurisdictions

The Region is located entirely within the County of San Diego. The County is comprised of five Board of Supervisor Districts, each represented by one elected official. Districts 1, 3, and 4 are entirely within the Region, and approximately the western two-thirds of Districts 2 and 5 are within the Region. Through authorities delegated by the State Board and its Division of Drinking Water (DDW), the County maintains local regulatory oversight within the Region on drinking water wells, monitoring wells, small water systems, recycled water use, and the beach recreational water quality program. The County also regulates on-site wastewater systems through an agreement with the San Diego Water Board.

Eighteen incorporated municipalities exist within the Region, including the Cities of Carlsbad, Chula Vista, Coronado, Del Mar, El Cajon, Encinitas, Escondido, Imperial Beach, La Mesa, Lemon Grove, National City, Oceanside, Poway, San Diego, San Marcos, Santee, Solana Beach, and Vista.

The San Diego Association of Governments (SANDAG) is the regional planning agency for San Diego County and provides a forum for regional decision making. SANDAG's Board of Directors includes representatives from each of the 18 municipalities as well as the County. Some SANDAG activities include regional population, land use, and demographic projections, transportation planning and construction, and extensive GIS database management for regional jurisdictional, demographic, and infrastructure data.

Other special districts in the Region include the San Diego County Regional Airport Authority and the San Diego Unified Port District, among others.

Physical and Hydrologic Characteristics

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 and faces similar water quality problems.

Imported Water Supply

Imported water supplied by the Water Authority is the predominant source of supply within the Region. The Region's imported water supply infrastructure crosses watershed and jurisdictional boundaries and requires coordination among local agencies and entities to address water supply, water quality, and habitat issues. This broader perspective promotes funding for regional projects and increases the economy of scale for the Region's local supply development projects.

Wastewater Service

Wastewater generated in the Region is either locally recycled or exported to one of the regional ocean outfall disposal systems. The Region's urban wastewater agencies have organized – through the formation of Joint Powers Authorities (JPAs) and interagency contracts – into five multi-jurisdictional wastewater systems based around the Region's five deep-water ocean outfalls. This shared infrastructure requires a high level of collaboration and coordination between local agencies within the Region. Some of the Region's agencies are collaborating with the International Boundary and Water Commission (IBWC) to address cross border issues, including trash and wastewater pollution in the shared Tijuana River watershed.

3.3 Disadvantaged Communities, Economically Distressed Areas, and Underrepresented Communities

Disadvantaged Communities (DACs) are low income communities that are given special consideration in IRWM planning and funding. Economically Distressed Areas (EDAs) and Underrepresented Communities (URCs) may or may not be a DAC, but still represent communities that may face additional barriers to participation in the IRWM Program or in addressing priority water-resource issues and needs. Under Proposition 1 both DACs and EDAs are eligible for funding designated for DACs – a minimum of 10% of the San Diego Funding Area's allocation for both planning and implementation. Each of these types of communities is described here, followed by general information regarding some of the highest priority water-related issues and needs of these communities.

The San Diego IRWM Plan acknowledges that not all of the issues apply to all DAC, EDA, and URC communities, and that some communities that are considered as DAC, EDA, or URC per the state's definitions, may not accept that designation. Additionally, the 2019 IRWM Plan includes communities experiencing environmental justice (EJ) issues as deserving of special concern on par with DACs, EDAs, and URCs, and are referred to as EJs, a subset of URCs.

During the 2019 IRWM Plan Update, the RWMG completed a Water Needs Assessment (in partnership with the Tri-County FACC). The 2019 Water Needs Assessment included DACs, EDAs, URCs, and EJ communities mapping, targeted outreach to mapped DAC, EDA, URC, and EJ communities, and a questionnaire about specific water and wastewater system needs. As a result of the Water Needs Assessment, the Region improved its understanding of DAC, EDA, URC, and EJ water resource-related needs and priorities, identified DAC, EDA, URC, and EJ communities that were not captured using standard mapping techniques with Census data through partnering with non-governmental organizations, and improved its understanding of how to better engage with DACs, EDAs, URCs, and EJ communities. A Needs Assessment is also required by DWR to remain eligible for reserved DAC funding.

DACs, EDAs, URCs, and EJs

DACs, EDAs, and URCs are terms used by DWR and some may be defined using easily-mappable data. DACs are communities with an MHI 80% or less of statewide MHI and can be mapped using U.S. Census data or other income data. EDAs are similar to DACs, in that they must meet certain population and economic thresholds but must also meet at least one other criteria – 1) low population density, 2) unemployment rate 2% higher than statewide, or 3) economic hardship.

In the San Diego IRWM Plan, the term "EJ" is used to mean "communities experiencing water-related EJ issues". URCs and EJs are both harder to map than EDAs and DACs, and in many ways cannot be truly mapped, as they are more likely to be made of communities of individuals with shared experiences or backgrounds, rather than a physical, location-based community. However, URCs and EJs are both communities that do not have equal access to water resource-related decision-making, or historically have not been involved in such decision-making. For the San Diego IRWM Program, an EJ is considered a subset of URCs.

3.3.1 Disadvantaged Communities

DACs are defined by DWR as communities with a combined Median Household Income (MHI) of less than 80% of the statewide MHI (DWR and State Board, 2016). The 2016 IRWM Guidelines define DACs based on data from the 2010-2014 American Community Survey (ACS). Based on the most recent ACS data (2012-2016 5-year estimates), DACs are those areas with an MHI of $51,026. DWR has also defined Severely Disadvantaged Communities (SDAC) as Census geographies having less than 60% of the annual Statewide MHI. Using 2012-2016 ACS data, the SDAC MHI threshold is $37,091.

The DAC information presented in Figure 3-4A and Figure 3-4B and discussed in the following sections represents the best available data on the location and nature of economically disadvantaged communities in the Region and does not constitute final or complete representation of DACs due to the scale of the data available. Additional income survey and other reliable data sources that demonstrate the location and nature of DACs in the Region may be used to further refine the data set and can be used for purposes of justifying grant eligibility based on DAC criteria.

3.3.2 Economically Distressed Areas

As defined by DWR, an EDA is a municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality with a population of 20,000 persons or less, with a MHI that is less than 85% of the Statewide MHI, and with one or more of the following conditions:

1) Financial hardship
2) Unemployment rate at least 2% of higher than statewide average
3) Low population density

The San Diego IRWM Program further defined the above terms and conditions. In this 2019 IRWM Plan, a reasonably isolated and divisible segment is defined as either:

- A community, Census block, tract, or other area within a larger municipality that is separated by major transportation corridors, waterbodies, or other physical barriers; or
- A segment with separate (disconnected from municipal services) water or wastewater services or other jurisdictional boundaries, such as senior living, fixed income, or other communities, where more than a quarter of the population does not have access to an automobile, or where more than a quarter of the population are non-English speakers.

The San Diego IRWM Program defines financial hardship as when the MHI for a community is less than 80% of the statewide annual MHI, or the MHI for a community is less than 85% of the regional or local MHI. Income data may be calculated using U.S. Census data, ACS data, income surveys, or other justifiable local knowledge (e.g., neighborhood has been designated low-income by its municipality, or community is a state- or federally-designated Colonia).

The statewide average unemployment rate was 5.4% as of August 2017, and thus communities having 7.4% and higher unemployment rates would meet the criterion of having an unemployment rate at least 2% higher than the statewide average. Local unemployment rates may use U.S. Census data, ACS data, or local economic agencies, so long as the data use a reasonable scale.

Low population density is defined as less than 100 persons per square mile, consistent with DWR's EDA mapping tool's methodology. Population density may be determined using ACS data, or local data.

While Figure 3-4C shows the location of some EDAs, others are difficult to map on a regional scale. As such, stakeholders are encouraged to explain how a community meets these EDA criteria when submitting projects for funding consideration or at other times when knowing an area's EDA status may be of use.

3.3.3 Underrepresented Communities and Environmental Justice

DWR does not formally define URCs but recognizes Native American Tribes as traditionally underrepresented. The San Diego IRWM Program defines URCs as communities that currently have little or no representation in water policy decision-making and/or water resource management projects, or who historically have disproportionately less representation in public policy or decision-making forums. All Native American Tribes are considered URCs under the state's IRWM Program, regardless of their economic status.

Communities experiencing environmental justice concerns are a subset of URCs in this 2019 IRWM Plan. The U.S. EPA defines Environmental Justice as:

> *…the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies…It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.*

Environmental justice seeks to ensure that land use plans, policies, and actions do not disproportionately affect low income and minority communities. Environmental justice is achieved when everyone, regardless of race, culture, or income, enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work. The 2019 IRWM Plan considers a community experiencing EJ issues as one that is mapped with an EJ Index of 80-100 percentile for any EJ Index compared to the State on the EPA's EJScreen tool (https://ejscreen.epa.gov/mapper/). EJ indices consider a variety of air quality impacts to human health (particulate matter, air toxic cancer risk, and respiratory hazard), traffic proximity and noise, lead paint, superfund and hazardous waste locations, and wastewater discharges, among others. EJs may also be mapped using CalEviroScreen, maintained by the California Office of Environmental Health Hazard Assessment (OEHHA). A community is considered to experience EJ issues under the 2019 IRWM Plan if it falls within the 80-100% percentiles in CalEnviroScreen.

Figure 3-4C shows the location of easily mapped URCs and EJs. Similar with EDAs, not all URCs or EJs may be shown in the map, and stakeholders are encouraged to explain how a community is considered a URC or EJ when submitting projects. In many cases, URCs are communities in the sense of people with common experiences, backgrounds, or reasons for underrepresentation, rather than a physical location, and therefore may be found anywhere within the Region. Further, it can be difficult to come to consensus on the types of people-based communities (versus location-based communities) that may be considered URCs.

3.3.4 DAC, EDA, and URC Considerations

Several communities and rural areas within the Region have an average MHI that is less than 80% of Statewide. The 2019 IRWM Plan uses various geographic designations to analyze DACs, including cities, County of San Diego community planning areas, and City of San Diego community planning areas. However, the use of larger planning areas can at times cause smaller portions of the planning area that are economically disadvantaged to be overlooked. For the 2019 Water Needs Assessment, MHI values were assessed at the Census Place, tract, and block-group levels to identify smaller pockets of DACs for potential outreach. Figure 3-4A illustrates the community planning areas (CPAs) within the Region that meet the MHI criteria for DACs. Figure 3-4B shows those areas within the City of San Diego that meet the DAC MHI criteria defined by DWR. Figure 3-4A also demonstrates the location of DACs with respect to the Water Authority's service area, which is used to distinguish Urban and Rural DACs as described below. Based on the 2012-2016 ACS data, nine of the County's 18 incorporated cities are considered DACs or contain DACs; these cities are El Cajon, Imperial Beach, Oceanside, Carlsbad, Escondido, San Marcos, Vista, National City, and San Diego. Additionally, based on the same data, 24 of the 58 City of San Diego CPAs and 15 of the 30 County CPAs are considered DACs or contain areas that qualify as DACs.

Table 3-9 summarizes communities (by planning area) within the Region that meet DWR and State Board criteria for designation as DACs. For the 2019 IRWM Plan, this table was updated to also show EDAs and URCs. The CPAs shown in the table are all CPAs in the Region that contain at least some DAC areas. Some CPAs are entirely or primarily DAC, while others (denoted by an asterisk) only contain small pockets of DACs. The table also shows how the DAC status for these areas has changed since 2000. The DACs are geographically distributed throughout the Region.

2012-2016 ACS data indicated that numerous Census tract and block-group neighborhoods in many of the Region's planning areas (both in incorporated and unincorporated areas) have MHIs that are less than 80% of the statewide MHI. The San Diego IRWM Program has relied on engagement of organizations who serve DACs as the primary means of engaging with DACs. Under the 2019 Water Needs Assessment, targeted outreach was made to DACs, EDAs, and URCs, with additional effort to identify and engage with DACs, EDAs, and URCs with no or limited previous participation in IRWM. To this purpose, the RWMG partnered with two non-governmental organizations (NGOs), Climate Science Alliance (CSA) and Rural Community Assistance Corporation (RCAC), to leverage their existing relationships with DACs, EDAs, and URCs in the Region and expand the Region's stakeholder list. Following distribution of information about IRWM to the expanded DAC, EDA, and URC contact list, the RWMG arranged a series of Community Meetings to provide additional information about how to participate in the IRWM Program, explain the benefits of doing so, improve understanding of barriers to participation, and solicit information on individual communities' water resource issues and needs.

DAC advocates have indicated that additional efforts to validate DACs in the Region are necessary, because U.S. Census data often may not fully capture the true economic conditions of various communities in San Diego County, particularly those communities with a high number of undocumented residents, tribal communities, or other residents that may not fully participate in providing information to the U.S. Census. During the outreach conducted for the 2019 Water Needs Assessment, no additional DAC, EDA, or URCs were identified by participants. Community mapping was presented during public workshops held on the Draft Water Needs Assessment in April 2019, and provided an opportunity for additional input on location of DACs, EDAs, and URCs. These workshops also served as an opportunity to solicit input from DAC, EDA, URC and EJ residents on the findings of the 2019 Water Needs Assessment. Feedback received was incorporated into the Final 2019 Water Needs Assessment released in May 2019. The addition of EDAs and URCs has expanded the State's understanding of those communities that may require additional support to address their water resource concerns. Because not all EDAs and URCs are easily mapped, the 2019 IRWM Plan encourages stakeholders and project proponents to explain how their community or project area comprises EDAs or URCs as defined in this 2019 IRWM Plan or in appropriate governmental guidelines. This allows local understanding of an area to supplement State and federal data and allows for additional nuance not previously available.

Table 3-9: Economically Disadvantaged Communities

HU[1]	Name[2]	Disadvantaged City or Community Planning Area (CPA)[3]	Jurisdiction	Urban or Rural	2000 DACs[4]	2010 DACs[4]	2013 DACs[4]	2019 DACs, EDAs, or URCs[4]
901 902	San Juan Santa Margarita	Pendleton-DeLuz CPA	County	Rural	✓	✓	✓	✓
902 903	Santa Margarita San Luis Rey	Palomar Mountain CPA	County	Rural		✓	✓	✓
		Fallbrook CPA*	County	Urban		✓	✓	✓
903	San Luis Rey	North Mountain County CPA	County	Rural	✓	✓	✓	✓
		Pala-Pauma CPA	County	Rural		✓		
903 904	San Luis Rey Carlsbad	City of Oceanside*	City of Oceanside	Urban		✓	✓	
		City of Carlsbad*	City of Carlsbad	Urban		✓	✓	
904	Carlsbad	North County Metro CPA	County	Urban		✓	✓	✓
		Twin Oaks CPA*	County	Urban		✓	✓	✓
		City of San Marcos	City of San Marcos	Urban		✓	✓	
		City of Escondido	City of Escondido	Urban		✓	✓	
906	Peñasquitos	Miramar Air Station CPA	City of San Diego	Urban		✓		
		Mission Bay Park CPA	City of San Diego	Urban		✓	✓	
		Rancho Peñasquitos CPA*	City of San Diego	Urban		✓	✓	
		University CPA*	City of San Diego	Urban		✓	✓	✓
		La Jolla CPA*	City of San Diego	Urban		✓	✓	
		Clairemont Mesa CPA*	City of San Diego	Urban		✓	✓	✓
		Pacific Beach CPA*	City of San Diego	Urban		✓	✓	
905 906	San Dieguito San Diego	Ramona CPA*	County	Urban		✓	✓	✓
907	San Diego	Bostonia County/Lakeside CPA*	County	Urban	✓	✓	✓	✓
		Central Mountain CPA	County	Rural		✓		✓
		Julian CPA	County	Rural		✓	✓	✓
		City of El Cajon	City of El Cajon	Urban	✓	✓	✓	✓
		Rancho Bernardo CPA*	City of San Diego	Urban		✓	✓	
907 908	San Diego Pueblo	Normal Heights CPA	City of San Diego	Urban	✓	✓	✓	✓
		College Area CPA	City of San Diego	Urban	✓	✓	✓	✓
		Ocean Beach CPA	City of San Diego	Urban	✓			✓
		Midway CPA	City of San Diego	Urban	✓	✓	✓	✓
		County Islands CPA	County	Urban		✓	✓	
		Old San Diego CPA	City of San Diego	Urban	✓	✓	✓	✓
		Kensington-Talmadge CPA*	City of San Diego	Urban		✓	✓	✓
907 909	San Diego Sweetwater	Alpine CPA*	County	Rural		✓		✓
		Cuyamaca CPA	County	Rural		✓		✓
		Descanso CPA*	County	Rural		✓		
908	Pueblo	Barrio Logan CPA	City of San Diego	Urban	✓	✓	✓	✓
		Centre City CPA	City of San Diego	Urban	✓			
		Spring Valley CPA	County	Urban		✓	✓	✓
		City Heights CPA	City of San Diego	Urban	✓	✓	✓	✓
		Eastern Area CPA	City of San Diego	Urban	✓	✓	✓	✓
		Greater Golden Hill CPA	City of San Diego	Urban	✓	✓	✓	✓
		Greater North Park CPA	City of San Diego	Urban	✓			✓

HU[1]	Name[2]	Disadvantaged City or Community Planning Area (CPA)[3]	Jurisdiction	Urban or Rural	2000 DACs[4]	2010 DACs[4]	2013 DACs[4]	2019 DACs, EDAs, or URCs[4]
		Encanto CPA	City of San Diego	Urban	✓	✓	✓	✓
		Lindbergh Field CPA	City of San Diego	Urban	✓	✓		
		Southeastern San Diego CPA	City of San Diego	Urban	✓	✓	✓	✓
		Uptown CPA*	City of San Diego	Urban		✓	✓	✓
908 909	Pueblo Sweetwater	City of National City	City of National City	Urban	✓	✓	✓	✓
		Skyline-Paradise Hills CPA*	City of San Diego	Urban		✓	✓	✓
910 911	Otay Tijuana	City of Imperial Beach	City of Imperial Beach	Urban	✓	✓	✓	✓
		Otay Mesa - Nestor CPA	City of San Diego	Urban		✓	✓	✓
911	Tijuana	San Ysidro CPA	City of San Diego	Urban	✓	✓	✓	✓
		Mountain Empire CPA	County	Rural	✓	✓	✓	✓
		Desert CPA	County	Rural		✓	✓	
911 909	Tijuana Sweetwater	Pine Valley CPA	County	Rural		✓	✓	✓
		80% Statewide Median Household Income			*$37,520*	*$48,706*	*$46,979*	*$51,026*

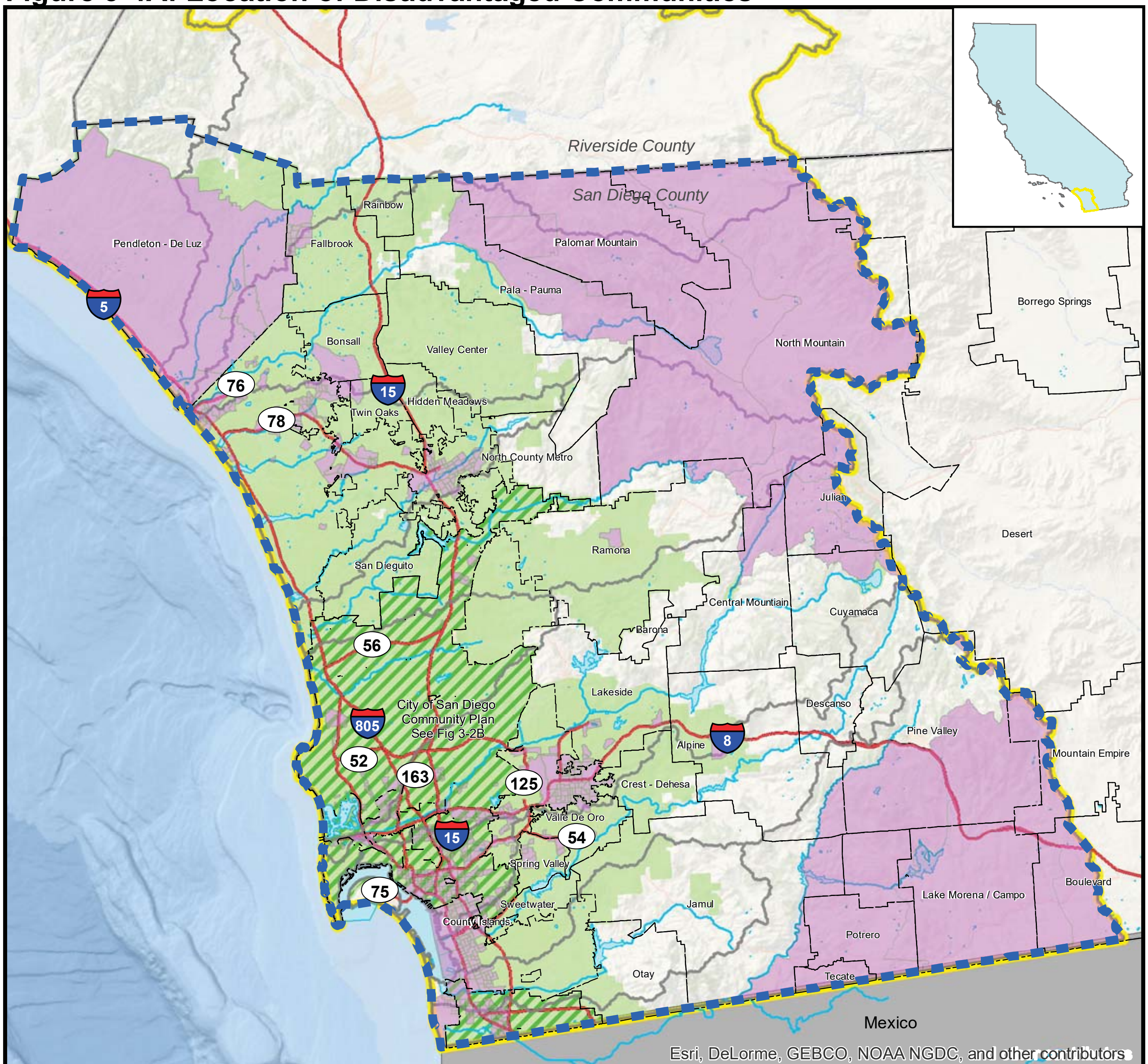
1 Numerical watershed (hydrologic unit) designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

2 Some planning areas fall within multiple watersheds

3 * denotes a CPA that contains small pocket(s) of DAC

4 DACs are defined by DWR as communities with an MHI of 80% or less than statewide MHI. As statewide incomes change and local incomes changes, the DAC status of a community, as defined by DWR, may also change. EDAs and URCs are new to the IRWM Program under the 2016 IRWM Guidelines.

Figure 3-4A: Location of Disadvantaged Communities



Legend

- Disadvantaged Communities
- Community Planning Area
- Watershed
- San Diego IRWM Region
- Funding Area Boundary
- Water Authority Boundary
- City of San Diego Boundary
- County
- River
- Freeway

Cities Defined as Disadvantaged Communities

City of National City
City of Imperial Beach
City of El Cajon

N

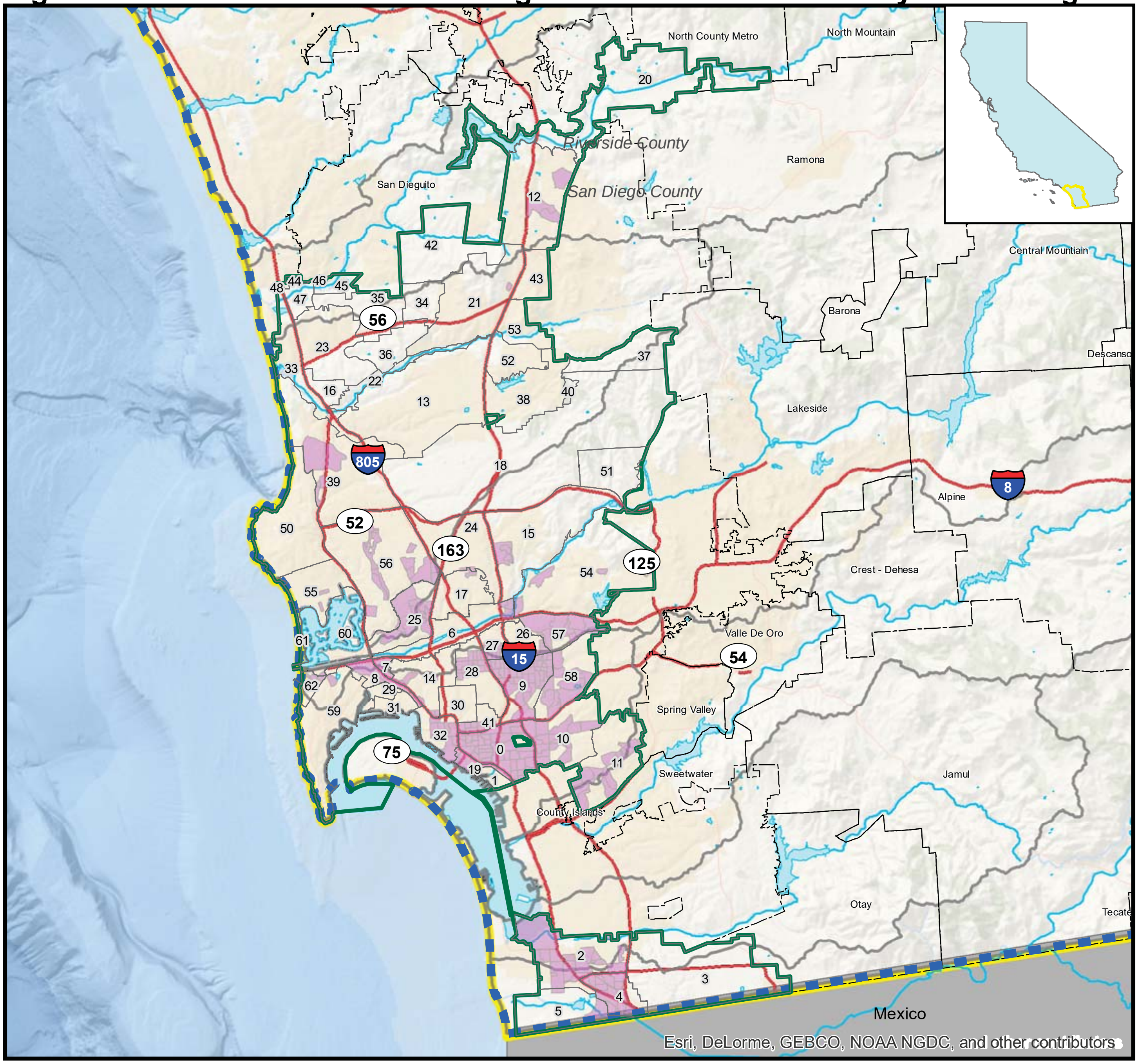
0 2.5 5 10
Miles

WOODARD &CURRAN

Based on 2010-2014 American Community Survey (ACS) Data. DAC defined as a block group with a median household income (MHI) of less than $51,026 (80% of the Statewide MHI).

Document Path: \\woodardcurran.net\shared\Projects\RMC\SD\Projects_GIS\0188-003 SDIRWM Plan Update\DAC Involvement_April 2016\MXDs\SDIRWM_Fig3-4A_DACMap_16Aug18.mxd

Figure 3-4B: Location of Disadvantaged Communities within City of San Diego



Legend

- Disadvantaged Communities
- Community Planning Area
- Watershed
- San Diego IRWM Region
- Funding Area Boundary
- City of San Diego Boundary
- County
- River
- Freeway

Community Planning Areas Defined as DACs

2 - Barrio Logan CPA
6 - Clairemont Mesa
8 - Greater Goldern Hill CPA
11 - Encanto CPA
14 - Midway CPA
24 - Old San Diego CPA
25 - Otay Mesa-Nestor CPA
28 - Greater North Park CPA
33 - San Ysidro CPA
37 - Southeastern San Diego CPA
38 - College Area CPA
42 - Uptown CPA
44 - Skyline-Paradise Hills CPA
56 - City Heights CPA
57 - Eastern Area CPA
58 - Kensington-Talmadge CPA
59 - Normal Heights CPA
62 - Ocean Beach CPA
99 - University CPA

N

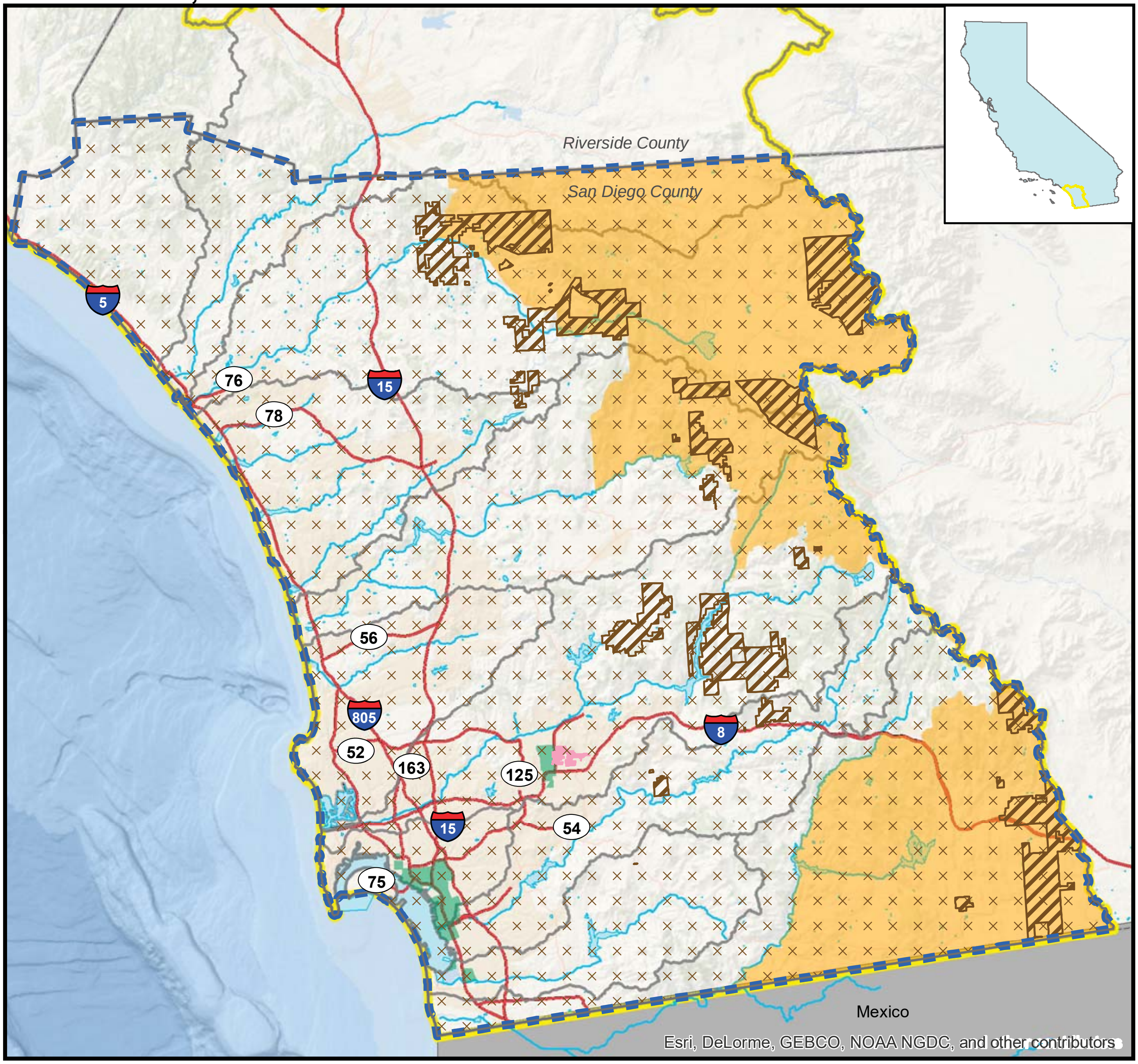
0 1.25 2.5 5
Miles

WOODARD & CURRAN

Based on 2010-2014 American Community Survey (ACS) Data. DAC defined as a block group with a median household income (MHI) of less than $51,026 (80% of the Statewide MHI).

Document Path: \\woodardcurran.net\shared\Projects\RMC\SD\Projects_GIS\0188-003 SDIRWM Plan Update\DAC Involvement_April 2016\MXDs\SDIRWM_Fig3-4B_DACMap_16Aug18.mxd

Figure 3-4C: Location of Economically Distressed Areas, Underrepresented Communities, and Environmental Justice Communities



Legend

- < 85% CA MHI; Pop </= 20K with Unemp 2% > CA Avg. (EDA)
- < 85% CA MHI; Pop </= 20K with Low Pop Density (EDA)
- Underrepresented Community (URC)*
- Tribal Lands
- Environmental Justice Index 80-100 Percentile (EJ)
- Watershed
- San Diego IRWM Region
- Funding Area Boundary
- County
- River
- Freeway

N

0 2.25 4.5 9
Miles

WOODARD & CURRAN

Based on 2010-2014 American Community Survey (ACS) data. EDA is a municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality with a population of 20,000 persons or less, with a median household income (MHI) that is less than 85% of the Statewide MHI, and with one or more of the following conditions: 1) Financial hardship, 2) Unemployment rate at least 2% of higher than statewide average, or 3) Low population density.

Document Path: \\woodardcurran.net\shared\Projects\RMC\SD\Projects_GIS\0188-003 SDIRWM Plan Update\DAC Involvement_April 2016\MXDs\SDIRWM_Fig3-4C_EDA_URC_EJsMap_16Aug18.mxd

DAC/EDA/URC Assistance

Organizations working in the Chollas Creek area, which flows through a disadvantaged community, have received grants to improve surface water quality and habitat.

Photo credit: Leslie Reynolds, Groundwork San Diego-Chollas Creek

Over the last decade, the RWMG has worked directly with many organizations that are involved with addressing water-related issues of DACs, EDAs, and URCs (including EJ communities) within the Region, including: San Diego Coastkeeper, Environmental Health Coalition, RCAC, Jacobs Center for Neighborhood Innovation, Groundwork San Diego-Chollas Creek, WildCoast, and others. Outreach has focused on identifying DAC, EDA, and URC issues, needs, and concerns, as well as ensuring representation on the RAC.

Within the San Diego IRWM Region, DACs, EDAs, and URCs are typically classified as either Urban – those communities that are located within the Water Authority's service area (with municipal water and wastewater service), or Rural– those communities that exist outside the bounds of a city or are not served by a Water Authority member agency. This distinction aids planners in addressing the true needs of DACs, EDAs, and URCs in the Region, as Rural and Urban DACs, EDAs, and URCs face different issues and challenges. Some areas are rural in nature due to their distance from the Region's urban core, but they are served by large public water systems. As a result, these communities are generally referred to as urban in this IRWM Plan and in the Water Needs Assessment, though they are recognized as having characteristics of both Rural and Urban DACs, EDAs, and URCs. One such community, which includes Ramona, is provided water services by Ramona MWD, a Water Authority member agency.

In 2010, 2012, 2013, 2017, and 2018 targeted outreach to DACs was undertaken by the RWMG (EDAs and URCs were targeted in 2017 and 2018 as part of the 2019 Water Needs Assessment). The purpose of this outreach effort was to develop an understanding of the water needs in DACs, EDAs, and URCs within the Region, and increase awareness of IRWM funding opportunities.

Urban DACs/EDAs/URCs Issues and Needs

As described above, Urban DACs, EDAs, and URCs fall within the service area of a water or wastewater agency. There are some DACs, EDAs, and URCs that have rural characteristics but still receive municipal services. For the purposes of this IRWM Plan, such DACs, EDAs, and URCs are considered Urban. Of the communities in the Region that have been identified as DACs, EDAs, and URCs using 2012-2016 ACS data, the majority are Urban DACs. EJs are concentrated in the central portion of the City of San Diego, as well as central El Cajon, and overlie DACs. Areas that include Urban DACs, EDAs, and URCs are identified in Table 3-9, above.

Because Urban DACs, EDAs, and URCs are located within water agency service areas, their water resources needs are generally centered on community development and surface water quality issues, rather than drinking water quality or drinking water supply issues, as they receive safe drinking water through their water agency. Historically, DWR's definition of a critical water supply or water quality need of a DAC, EDA, or URC has often failed to encompass what the Urban DACs, EDAs, and

URCs (and their relevant planning agencies) consider a critical water supply or water quality need. Therefore, it can be challenging to obtain funding for Urban DAC, EDA, and URC water projects, as they may not qualify for the funding match waivers frequently provided for DAC, EDA, and URC projects. Additionally, URCs may not be eligible for funding match waivers or other special considerations provided to DACs and EDAs, depending on the funding program, increasing the challenges to their ability to address critical water and wastewater issues. While Urban DACs, EDAs, and URCs in the Region receive safe drinking water from local water agencies, increases in water rates can have a disproportionate impact on DAC and EDA residents, because they tend to spend a larger percentage of their income on water compared to those in higher-income communities (refer to *Section 3.10* for more information). Some URCs may also experience disproportionate impacts associated with policy decisions due to underrepresentation in the decision-making process.

Urban DACs and EDAs may also be characterized by aging and undersized infrastructure, constrained or realigned drainage ways, erosion, over-growth of invasive species, and illegal dumping. Urban DACs and EDAs cited aging infrastructure in the 2019 Water Needs Assessment as one of the most pressing needs for funding, especially regarding water supply and wastewater systems. Drought and flooding were both identified by stakeholders as contributors to wastewater infrastructure failure and water quality issues. Water conservation measures have caused declining flows in the wastewater system, especially dry weather flow diversion. Lower flows result in higher concentration of waste system and subsequent operation and maintenance (O&M) issues. Urban DAC and EDA areas may also be more prone to flooding from introduction of impervious surfaces associated with development and the typically lesser amount of parks or other non-paved recreation lands. To improve surface permeability while not restricting economic growth potential in Urban DACs and EDAs, more assistance is needed for such measures as de-channelization, hydro-modification, and implementing Low Impact Development (LID) projects to reduce stormwater runoff and associated flooding. These types of projects may also enhance the opportunities to provide increased access to recreational areas, which is needed in most Urban DACs and EDAs. This sentiment was echoed in the 2019 Water Needs Assessment where a few stakeholders expressed an interest in green infrastructure and community outreach that emphasizes holistic stormwater solutions to provide multiple capture and filtration benefits for communities.

Water quality concerns in urban creeks can result from illegal dumping, invasive species, and constituents conveyed by stormwater and other runoff.

Photo credit: Leslie Reynolds, Groundwork San Diego-Chollas Creek

Rain events convey pollutants to drainage facilities, creeks, and other downstream receiving waters. Stormwater runoff (as well as dry weather urban runoff) may thus convey pollutants contributing to the poor surface water quality in Urban DACs and EDAs, similar to how runoff conveys pollutants in other urban and developed areas. Although many of the residents of Urban DACs and EDAs are aware of the pollution problems, and TMDLs have been developed for some streams that traverse Urban DACs and EDAs, challenges remain. For example, while TMDLs for metals and bacteria in Chollas Creek have been developed, illegal dumping (especially of large trash items such as mattresses) in creeks and watersheds is a common problem that contributes to water quality issues in Urban DACs and EDAs. In June 2017, the San Diego

Water Board issued Order No. R9-2017-0077, which applied to the MS4 Copermittees. This order implemented statewide requirements to address the impacts of trash on surface waters. Copermittees are in the process of identifying which BMPs should be implemented to eliminate trash and comply with the order. Future MS4 permits are anticipated to include trash requirements and compliance milestones and schedules. Watershed stakeholders have reported that homelessness presents water quality issues throughout the Region, especially in homeless encampments located alongside the Region's water bodies that are prone to becoming a place for trash and other illegally-dumped items to accumulate, as well as a source of human waste entering local waterways. This concern was also identified by stakeholders through the 2019 Water Needs Assessment in regard to stormwater pollution downstream of homeless encampments and in the Tijuana River Watershed and coastal waters near the U.S.-Mexico border.

Pollution of San Diego Bay (Bay) waters also substantially impacts Urban DACs and EDAs, many of which are located adjacent to the Bay, near industrial areas. Bay pollution from industry, runoff, and other activities has negatively impacted fishermen, many of whom are residents of Urban DACs and EDAs. Although huge investments have been made to date, additional water quality monitoring in Bay wetlands, again many of which are located near or in Urban DACs and EDAs, is needed to fully understand and address water quality issues. Low-lying Urban DACs and EDAs near the Bay will also suffer disproportionately from the effects of sea level rise as a result of climate change compared to their non-DAC or EDA counterparts that may also be directly affected by sea level rise. These areas will be more susceptible to floods and inundation from storm surges, which are anticipated to be larger and more frequent.

One of the biggest issues facing Urban DACs, EDAs, and EJs is food security. Food security is one of the highest priorities in these areas and must be addressed before full DAC, EDA, and EJ involvement in other issues, including water quality. Some Urban DACs, EDAs, and EJs use community gardens to help offset food needs, and irrigation costs may impact their ability to care for such gardens. An IRWM-funded project, Chollas Home Makeovers, is helping to install water efficient systems, including rainwater capture and greywater systems, in homes within the Encanto DAC. The water made available by this project is used to irrigate landscaping on the property, including newly planted fruit trees, which help to increase access to fresh and healthy food options.

Urban DACs, EDAs, and URCs, like their rural counterparts, frequently lack the financial and technological resources to design, implement, operate, and maintain water projects or enhance existing infrastructure. Because of this, they require financial assistance for project implementation, particularly to support ongoing O&M costs. NGOs that propose projects in Urban DACs, EDAs, and URCs should consider the long-term stewardship of the projects in question, and determine post-project ownership of any acquired land at the outset of the projects, to ensure the resources necessary to achieve the long-term benefits associated with the projects. For creek restoration projects, or those projects that improve recreational or access opportunities, public safety should always be considered. In Urban DACs, EDAs, and URCs, there may be a need for additional park rangers or security officers to ensure public safety in recreation areas.

Effective water conservation, watershed, and stormwater management outreach and education could be improved in Urban DACs, EDAs, and URCs. The need for additional outreach and education needs, as well as what kinds of outreach may be most effective for these communities will be explored in the Water Needs Assessment currently under development. Generally, outreach and education efforts that come from the community or peers are more effective than top-down through an agency. Outreach efforts should also aim to raise awareness of the existence of surface waters in Urban DACs, EDAs, and URCs, which will assist in improving stewardship of these resources. These efforts should be tailored to the community and be multilingual when targeting communities with high rates of non-English speaking households.

Priority projects in Urban DACs, EDAs, and URCs include those with education, creek restoration, passive recreation, hydro-modification, stormwater management/pollution prevention, public safety, and those that address sea level rise adaptation components.

Rural DACs/EDAs/URCs Issues and Needs

Rural DACs, EDAs, and URCs are located outside of the jurisdictional boundaries of the Region's water and wastewater agencies and are not provided municipal water supply or wastewater infrastructure. Rural DACs, EDAs, and URCs identified using 2012-2016 ACS data are shown in Table 3-9, above. No EJs were mapped within the rural areas of the San Diego IRWM Region.

Unlike their urban counterparts, Rural DACs, EDAs, and URCs are not consistently supplied with a safe source of municipal drinking water. Due to infrastructure, source water quality, and other issues, the primary water-related concern of Rural DACs, EDAs, and URCs is meeting drinking water needs with a safe, reliable source of potable water. Rural DACs, EDAs, and URCs often lack access to much-needed infrastructure and financing, as well as the resources to adequately maintain existing system facilities. As a result, drinking water systems in Rural DACs, EDAs, and URCs often face significant challenges in complying with longstanding and new drinking water rules (EPA, 2007).

Small water systems are defined by USEPA as those serving fewer than 10,000 people. Within San Diego County, the County's Department of Environmental Health regulates those systems under 200 connections, while larger systems are regulated by the State Board's DDW. Three major problems that impede the sustainability of small community water systems include:

1) contamination of drinking water source water from wastewater intrusion, agricultural influences, naturally occurring contaminants, and/or contaminant spills from industrial activities;
2) seasonal weather changes resulting in floods or droughts may require design options to bypass treatment during rain and storm events and identification of alternative water supplies (including water reuse sources) to increase capacity during droughts; and
3) deteriorating collection and distribution systems compromise source water quality and increase the cost of water treatment.

The issue of deteriorating systems was reiterated by rural San Diego DACs in the 2019 Water Needs Assessment. Rural communities within the San Diego IRWM Region's unincorporated areas have water supply and water quality issues that may be exacerbated by climate change, poor economies, and lack of community expertise. Inadequate water supply to support existing communities is a public health risk, especially considering that the rural portions of the Region are also those that are particularly susceptible to wildfires. The majority of drinking water maximum containment level (MCL) violations in the Region occur with small public water systems, and inadequate wastewater treatment can result in unplanned discharge events.

Some Rural DACs, EDAs, and URCs in the San Diego IRWM Region are faced with inadequate supplies to support existing connections. They may also face water quality issues that remain unresolved because it is costly to provide supplemental treatment processes to improve the quality of contaminated source waters. It is also difficult for small DAC, EDA, and URC systems to afford improvements because they have fewer ratepayers to share the costs. Further, Rural DACs, EDAs, and URCs may lack the technical expertise and financial stability to access available funding programs that could be implemented to address cost-related issues. Because of the lack of internal capacity for small water systems, a supporting agency that can provide capacity (such as engineering) to support necessary improvements for Rural DAC, EDA, and URC systems can be an invaluable partner for implementing solutions. The lack of technical capacity and support from agencies also contributes to the high cost of DAC projects through an inability to adequately perform O&M activities during the life of a system.

Some of the other issues facing Rural DACs, EDAs, and URCs include groundwater contamination, potentially from leaking septic tanks. Leaking or improperly sited septic tanks also pose a public health hazard, though the conversion from septic to sewer is expensive, and Rural DACs, EDAs, and URCs often struggle to find assistance in funding such projects. Specific issues with nitrate and uranium in groundwater were identified by some stakeholders in the 2019 Water Needs Assessment, leading to a reliance by those communities on bottled water for supply. The San Dieguito and San Diego groundwater basins have experienced contamination, as has the Otay/San Diego Formation, which is being considered by U.S. Geological Survey (USGS) for groundwater use. While water agencies may be able to achieve economies of scale that allow projects to pump and clean contaminated groundwater for use by their customers to be economically feasible, similar systems for Rural DACs, EDAs, and URCs may be impractical or infeasible.

Aging storage tanks can lead to contamination of rural water supplies.

Photo credit: Dave Harvey, Rural Community Assistance Corporation

Population growth and economic development reduces the land available for safely-sited septic systems, which either limits growth or requires the installation of wastewater management infrastructure. A need for improved land use planning to address this issue, specifically in rural areas, was identified by stakeholders during the 2019 Water Needs Assessment.

Drinking water supplies for some Rural DACs, EDAs, and URCs have also been contaminated with ash from recent wildfires. It is anticipated that the projected increase in wildfire frequency and intensity resulting from climate change will inordinately affect Rural DACs, EDAs, and URCs, which are more likely to be located near fire-prone areas and less likely to have the ability to defend against fires. Some Rural DACs, EDAs, and URCs lack sufficient water supplies for fire protection, further increasing the danger.

Illegal dumping, especially of chemicals or hazardous wastes in creeks and watersheds, is a common problem reported in Rural DACs and EDAs. Awareness of existing programs such as the County's permanent Household Hazardous Waste Collection Facilities in Ramona and El Cajon and the County's collection events that travel throughout unincorporated areas of the County can help to reduce illegal dumping and associated water quality impacts.

The infrastructure needs of Rural DACs, EDAs, and URCs are so extensive that there is not enough currently available funding to meet the needs of Rural DACs, EDAs, and URCs throughout the Region. The State Board has a lengthy list of communities requesting funding from the Clean Water and Drinking Water State Revolving Fund programs for drinking water and wastewater improvements in its 2017 Intended Use Plan (including two small community systems in San Diego County, of seven total projects from the San Diego IRWM Region). Additional challenges to obtaining funding for Rural DAC, EDA, and URC projects include a regulatory burden that is often too difficult for Rural DACs, EDAs, and URCs to meet as well as difficulties in providing matching funds.

To meet the needs of Rural DACs, EDAs, and URCs, the San Diego IRWM Region will need to identify solutions that recognize that the needs of Rural DACs, EDAs, and URCs differ from those of Urban DACs, EDAs, and URCs. To be most effective, the Region may develop and implement targeted, multilingual outreach to Rural DACs, EDAs, and URCs that is tailored to the community being addressed. For the 2019 Water Needs Assessment, the RWMG and its NGO partners conducted targeted outreach to Rural DACs, EDAs, and URCs to further the Region's understanding of needs specific to their communities. Finally, appropriate support must be provided to enable Rural DACs, EDAs, and URCs to develop projects, secure funding for projects, and properly operate and maintain their systems.

Community Support for DACs, EDAs, URCs, and EJs

In addition to the efforts of the San Diego IRWM Program, a variety of organizations in the IRWM Region work to address the needs of DACs, EDAs, URCs, and EJs:

San Diego Coastkeeper

The San Diego Coastkeeper's mission is to protect and restore fishable, swimmable, and drinkable waters in San Diego County. Coastkeeper enhances public awareness of water quality and other water-related issues through their extensive community outreach and participation program that involves hands-on stewardship activities such as beach cleanups and water quality sampling.

Rural Community Assistance Corporation

RCAC focuses its San Diego-based efforts in the rural portions of the Region that generally do not receive municipal water or wastewater services. RCAC completes a variety of work to address the needs of DACs and EJs, including providing technical assistance, training, and funding support.

California Rural Water Association

California Rural Water Association (CRWA) works to provide on-site technical assistance and specialized training for rural water and wastewater systems. Similar to RCAC, CRWA focuses its work on the rural portions of the Region that do not receive municipal water or wastewater.

Environmental Health Coalition

The Environmental Health Coalition (EHC)is a community-based organization founded in Barrio Logan, an Urban DAC. It works to achieve environmental and social justice through leader development, organizing, and advocacy. EHC focuses on green energy and jobs, healthy kids, border environmental justice, and toxic-free neighborhoods.

Groundwork San Diego

Groundwork San Diego–Chollas Creek works with the communities surrounding Chollas Creek to improve the creek and communities. It strives to create opportunities for people to learn new skills and take action, help businesses grow, and create safer and healthier neighborhoods. It achieves these goals through three overarching programs: 1) Environmental education, 2) Clean creeks and healthy habitats, and 3) Thriving communities.

Jacobs Center for Neighborhood Innovation

The Jacobs Center for Neighborhood Innovation seeks to create community change by teaming up with residents in under-invested communities. It seeks to empower residents to take ownership of the change they wish to see in their communities, and provide financial, technical, and other forms of support. The Jacobs Center works in Chollas View, Emerald Hills, Lincoln Park, Mountain View, Mount Hope, North Encanto, Oak Park, South Encanto, Valencia Park, and Webster.

Jacobs Center for Neighborhood Innovation serves an important role in improving creek conditions in Southeast San Diego.

Photo credit: Charles Davis, Jacobs Center for Neighborhood Innovation

Civic San Diego

Civic San Diego is a public non-profit founded by the City of San Diego following the dissolution of the Redevelopment Agency of the City of San Diego in 2012. Its main responsibility has been the redevelopment and subsequent revitalization of Downtown San Diego, though it also works in the surrounding neighborhoods, including four Urban DACS: Barrio Logan, City Heights, Southeastern, and San Ysidro.

3.4 Watersheds

As shown in Figure 3-1, the Region addressed in this IRWM Plan is composed of eleven watersheds that are tributary to coastal waters. The runoff captured within these watersheds meets approximately 15% of the region's overall water demands. The region supports a diversity of ecosystems, from coastal wetlands to inland mountains, which support more threatened and endangered species than any other comparable land area in the country (City of San Diego, 2016). Table 3-10 summarizes the characteristics of the eleven watersheds, which are described in greater detail in *Chapter 5, Watershed Characterizations*. As noted in the call-out box on page 3-10, the terminology used to describe watersheds and drainage areas can vary depending on the context. Within this IRWM Plan, the term "watershed" refers to a DWR-delineated hydrologic unit (HU), which may include one or more individual sub-watersheds. One or more sub-watershed may comprise a hydrologic area (HA), and some HAs are further broken down into hydrologic subareas (HSAs).

Table 3-10: Summary of the Region's Watersheds[1]

HU[2]	Name	Watershed Area (sq. miles)	Primary Watercourses or Hydrologic Areas	Approximate Length[3] (miles)	Elevation Range[4] (feet MSL)	Coastal Receiving Waters
901	San Juan	150[5]	San Mateo Creek San Onofre Canyon Las Pulgas Canyon	21	0 - 3575	Coastal estuaries/marshes Pacific Ocean
902	Santa Margarita River	200[6]	Santa Margarita River	55	0 – 6190	Santa Margarita Estuary Pacific Ocean
903	San Luis Rey River	558	San Luis Rey River	52	0 – 6530	San Luis Rey River Mouth Pacific Ocean
904	Carlsbad	210	Loma Alta Creek	8	0 – 460	Loma Alta Slough Pacific Ocean
			Buena Vista Creek	11	0 – 1670	Buena Vista Lagoon Pacific Ocean
			Encinas HA	4	0 - 350	Pacific Ocean
			Aqua Hedionda Creek	10	0 – 1300	Agua Hedionda Lagoon Pacific Ocean
			San Marcos Creek	14	0 – 1670	Batiquitos Lagoon Pacific Ocean
			Escondido Creek	24	0 – 2330	San Elijo Lagoon Pacific Ocean
905	San Dieguito River	346	San Dieguito River	42	0 – 5720	San Dieguito Lagoon Pacific Ocean
906	Peñasquitos	100	Los Peñasquitos Creek Rose Creek Tecolote Creek	18	0 – 2700	Los Peñasquitos Lagoon Mission Bay
907	San Diego River	440	San Diego River	44	0 – 6510	San Diego River Estuary Pacific Ocean
908	Pueblo	60	Chollas Creek	8	0 – 830	San Diego Bay Pacific Ocean
909	Sweetwater River	230	Sweetwater River	41	0 – 6510	Sweetwater River Estuary San Diego Bay
910	Otay River	160	Otay River	23	0 – 3720	San Diego Bay
911	Tijuana River	470[7]	Tijuana River	47	0 – 6380	Tijuana River Estuary Pacific Ocean

1 Adapted from basin descriptions presented in Comprehensive Water Quality Control Plan Report (San Diego Water Board, 1976).
2 Numerical watershed (hydrologic unit) designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 Approximate distance of eastern end of the watershed (within the USA) to the Pacific Ocean.
4 Approximate range of elevation in feet above mean sea level (MSL) within the watershed.
5 The San Juan Watershed comprises approximately 476 square miles. The lower 150 square miles of this watershed is within the County and the Region addressed within this IRWM Plan; this area includes four hydrologic areas: San Mateo, San Onofre, Las Pulgas, and Stuart Mesa. The upper portion of the watershed lies within Orange County and is addressed by that Region's IRWM Plan.
6 The Santa Margarita River Watershed area is approximately 750 square miles. The lower 200 square miles of this watershed is within the County and the Region addressed within this IRWM Plan. The remainder of the Santa Margarita River Watershed lies within Riverside County, and includes the communities of Temecula and Murrieta.
7 The Tijuana River Watershed is approximately 1,750 square miles; approximately 27% of the land area is within the Region.

3.5 Water Management Systems

This section includes an overview of the various water management systems in the San Diego IRWM Region, including water supply, wastewater, water reuse, stormwater, and flood control.

Table 3-11 presents a breakdown of member agency water supplies in 2015. Approximately 14% of the overall regional supply was from local sources (groundwater, local surface water, and recycled water). A total of ten member agencies use local surface water sources, of these nine develop potable supplies from the local surface waters, and ten member agencies develop local groundwater supplies. Additionally, 17 of the 24 Water Authority member agencies provide recycled water supply for irrigation purposes and other non-potable uses within their respective service areas. Table 3-12 provides an average supply breakdown for agencies reported in their 2005, 2010, and 2015 UWMPs.

Table 3-11: Member Agency Water Supply – Water Authority Service Area

Water Authority Member Agency	2015 Water Supply[1] (Acre-feet per Year)			Percent of Supply from Local Sources	Source of Member Agency Local Supply		
	Total Agency Supply	Water Authority Imported Supply	Member Agency Local Supply[2]		Recycled Water	Local Surface Water	Ground-water
Carlsbad MWD	20,609	16,403	4,206	20.41%	✓		
City of Del Mar	1,097	961	135	12.35%	✓		
City of Escondido	22,265	21,062	1,203	5.40%	✓	✓	
Fallbrook PUD	12,331	11,729	602	4.88%	✓	✓	
Helix Water District	31,145	30,852	293	0.94%		✓	✓
Lakeside Water Dist.	3,739	2,858	880	23.55%			✓
City of National City[3]	5,676	2,718	2,958	52.12%		✓	✓
City of Oceanside	26,449	23,082	3,367	12.73%	✓		✓
Olivenhain MWD	22,222	19,549	2,673	12.03%	✓		
Otay Water District	34,485	30,299	4,186	12.14%	✓		
Padre Dam MWD	11,322	10,437	886	7.82%	✓		
Camp Pendleton	8,026	220	7,806	97.26%	✓		✓
City of Poway	11,127	10,660	466	4.19%	✓		
Rainbow MWD	20,173	20,173	0	0.00%			
Ramona MWD	6,142	5,492	651	10.59%	✓	✓[4]	✓
Rincon Del Diablo MWD	8,882	5,744	3,138	35.33%	✓		
City of San Diego	191,674	184,493	7,181	3.75%	✓	✓	✓
San Dieguito Water Dist.	7,110	5,749	1,361	19.15%	✓	✓	
Santa Fe Irrigation Dist.	11,199	9,865	1,334	11.91%	✓	✓	
South Bay Irrigation Dist.[3]	13,555	11,236	2,319	17.11%		✓	✓
Vallecitos Water District	15,297	15,297	0	0.00%	✓		
Valley Center MWD	25,985	25,598	387	1.49%	✓		
Vista Irrigation District	17,833	16,216	1,618	9.07%		✓	✓
Yuima MWD	11,017	4,470	6,547	59.43%			✓
Total	**539,361**	**485,162**	**54,199**	**10.05%**			

Table 3-12: 10-Year Average Member Agency Water Supply – Water Authority Service Area

Water Authority Member Agency	2005-2015 Average Water Supply (Acre-feet per Year)			Percent of Supply from Local Sources	Source of Member Agency Local Supply		
	Total Agency Supply	Water Authority Imported Supply[1]	Member Agency Local Supply[2,3]		Recycled Water	Local Surface Water	Ground-water
Carlsbad MWD	21,417	17,902	3,516	16.42%	✓		
City of Del Mar	1,217	1,111	105	8.67%	✓		
City of Escondido	25,292	18,965	6,327	25.01%	✓	✓	
Fallbrook PUD	14,615	13,552	1,063	7.28%	✓	✓	
Helix Water District	33,225	28,462	4,763	14.34%		✓	✓
Lakeside Water Dist.	2,596	1,996	600	23.13%			✓
City of National City[3]	4,001	906	3,095	77.36%		✓	✓
City of Oceanside	29,608	25,385	4,223	14.26%	✓		✓
Olivenhain MWD	22,586	20,146	2,440	10.80%	✓		
Otay Water District	36,956	33,262	3,694	10.00%	✓		
Padre Dam MWD	15,022	13,987	1,036	6.90%	✓		
Camp Pendleton	10,372	637	9,735	93.86%	✓		✓
City of Poway	12,258	11,712	546	4.45%	✓		
Rainbow MWD	23,814	22,469	1,345	5.65%			
Ramona MWD	8,034	7,265	769	9.57%	✓	✓[5]	✓
Rincon Del Diablo MWD	8,815	6,482	2,333	26.47%	✓		
City of San Diego	202,707	183,506	19,201	9.47%	✓	✓	✓
San Dieguito Water Dist.	8,887	4,499	4,388	49.38%	✓	✓	
Santa Fe Irrigation Dist.	11,551	8,466	3,086	26.71%	✓	✓	
South Bay Irrigation Dist.[4]	16,332	10,110	6,222	38.10%		✓	✓
Vallecitos Water District	17,064	16,715	350	2.05%	✓		
Valley Center MWD	32,844	31,161	1,683	5.13%	✓		
Vista Irrigation District	20,428	15,269	5,159	25.26%		✓	✓
Yuima MWD	6,114	3,140	2,974	48.64%			✓
Total	**585,757**	**497,103**	**88,655**	**15.14%**	-	-	-

1 Imported supply data from Water Authority's Comprehensive Annual Financial Report (Water Authority, 2015) and 2010 UWMP (Water Authority, 2011b).
2 Local supply data from Comprehensive Annual Financial Report and 2005 UWMP (Water Authority, 2015 and 2007).
3 Includes local recycled water, surface water, and groundwater supplies. Does not reflect conserved water. Also does not include groundwater pumped by private well owners or surface water outside the Water Authority's service area.
4 Local water supply is from Sweetwater Authority (a joint powers agency comprised of the South Bay Irrigation District and City of National City).
5 Ramona MWD uses local surface water along with imported raw water for irrigation customers. Ramona MWD currently does not treat local surface water for potable use.

Local hydrologic conditions (precipitation, evaporation, and surface flows) influence both the quantity of water demand and the availability of local supplies within the Region. Total water use can also be influenced by local economic conditions, which contributed to the reduction in demands between 2007 and 2012. Drought conditions from 2012 through 2016 reduced supply availability and led to mandatory use restrictions. Demands in those years were lower than average, particularly 2014-2016, following the Governor's drought declaration in January 2014. Table 3-13, below, summarizes the variation in Region's local water supplies from 1999-2016.

Water Supply outside Water Authority Service Area

All but a small fraction of the Region's more than 3.2 million residents live within the service areas of the Water Authority's 24 member agencies (refer to Table 3-1). Rural residences and small communities that exist outside the Water Authority service area are entirely dependent on groundwater resources and rely exclusively on individual groundwater wells or community water wells operated by small community water systems or private water companies.

While the Region's groundwater-dependent population is relatively small (compared to the population served by the Water Authority's member agencies), the population is spread over a significant geographic portion of the Region. The availability of groundwater in the portion of the Region that lies east of the Water Authority's service area is limited by (1) available precipitation recharge, (2) recharge infiltration limitations, (3) low aquifer yields, and (4) limited groundwater storage capacity. The majority of this area is underlain by fractured rock aquifers. Such aquifers typically have well yields no more than several gallons per minute. Shallow alluvial valleys exist along several of the river and stream valleys in portions of the eastern section of the Region. Groundwater production from these shallow aquifers, however, is constrained by the limited aquifer storage. Overall, the factors listed above that limit groundwater yield severely constrain the potential of additional growth and development in this area of the County. Groundwater resources are discussed in more detail in *Section 3.5.6* Groundwater Resources.

While some community well systems outside the Water Authority's 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 Water Authority 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.

3.5.1 Water Authority Supplies

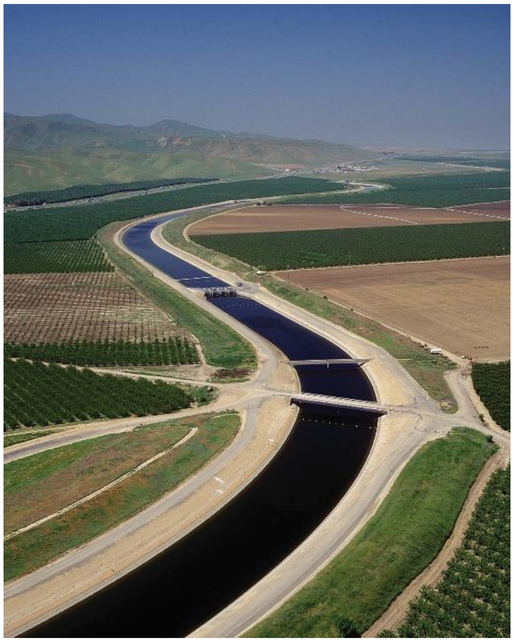
The Water Authority's water supply portfolio includes four primary sources: 1) Metropolitan Water District of Southern California (Metropolitan), 2) conserved agricultural water from the Imperial Irrigation District (IID), 3) conserved water from projects that lined the All-American and Coachella Canals, and 4) desalinated seawater from the Claude "Bud" Lewis Carlsbad Desalination Plant (Carlsbad Desalination Plant). The Water Authority has also acquired spot water transfers to offset reductions in supplies from Metropolitan during water shortage years.

Imported Water

Metropolitan is urban Southern California's wholesale water agency, and the Water Authority is the largest customer among Metropolitan's 26 member agencies. Metropolitan 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, with SWP water (originating from the Bay Delta) delivered to Metropolitan via the California Aqueduct.

In 1998, the Water Authority entered into a transfer agreement with IID to purchase conserved agricultural water. Through the agreement, the Water Authority received 70,000 acre-feet (AF) in 2010 and will receive an annually-increasing volume up to 200,000 AF by 2021. The volume then remains fixed for the remainder of the 75-year agreement. Metropolitan conveys the IID transfer water to the Water Authority via an exchange agreement. Through the 2003 Quantification Settlement Agreement (QSA) on the Colorado River and conserved water from lining of the All-American and Coachella Canals, the Water Authority has rights to 80,200 AFY (Water Authority, 2016).



Imported water provides approximately 80% of the Region's water supply.

Photo credit: San Diego County Water Authority

As shown in Table 3-13 and Figure 3-5, imported water supplies provided through the Water Authority have comprised between 80 and 90% of the Region's water supply in recent years. As reliable local water supplies expand, the Region's reliance on imported water is expected to be just over 60 percent in 2020.

The Water Authority takes delivery of the Metropolitan/IID transfer and canal lining project supplies at a point located six miles south of the San Diego County-Riverside County border. The Water Authority conveys imported water to its member agencies through two aqueducts that consist of five large-diameter pipelines. Figure 3-7 shows the locations of the Water Authority aqueducts. The aqueducts follow general north-to-south alignments, and the water is delivered largely by gravity. The First Aqueduct includes Pipelines 1 and 2, which are located in a common right-of-way and are operated as a unit. These pipelines have a combined capacity of 180 cubic feet per second (CFS). Pipelines 3, 4, and 5 form the Second Aqueduct. These pipelines are operated independently and are located in separate rights-of-way from the First Aqueduct. Pipelines 3, 4, and 5 have respective capacities of 280 CFS, 470 CFS, and 500 CFS. Key appurtenant facilities to the aqueduct system include flow control facilities, pump stations, control valves, and air release mechanisms. The Water Authority delivers the imported supply to member agencies via 88 turnouts along the aqueduct system.

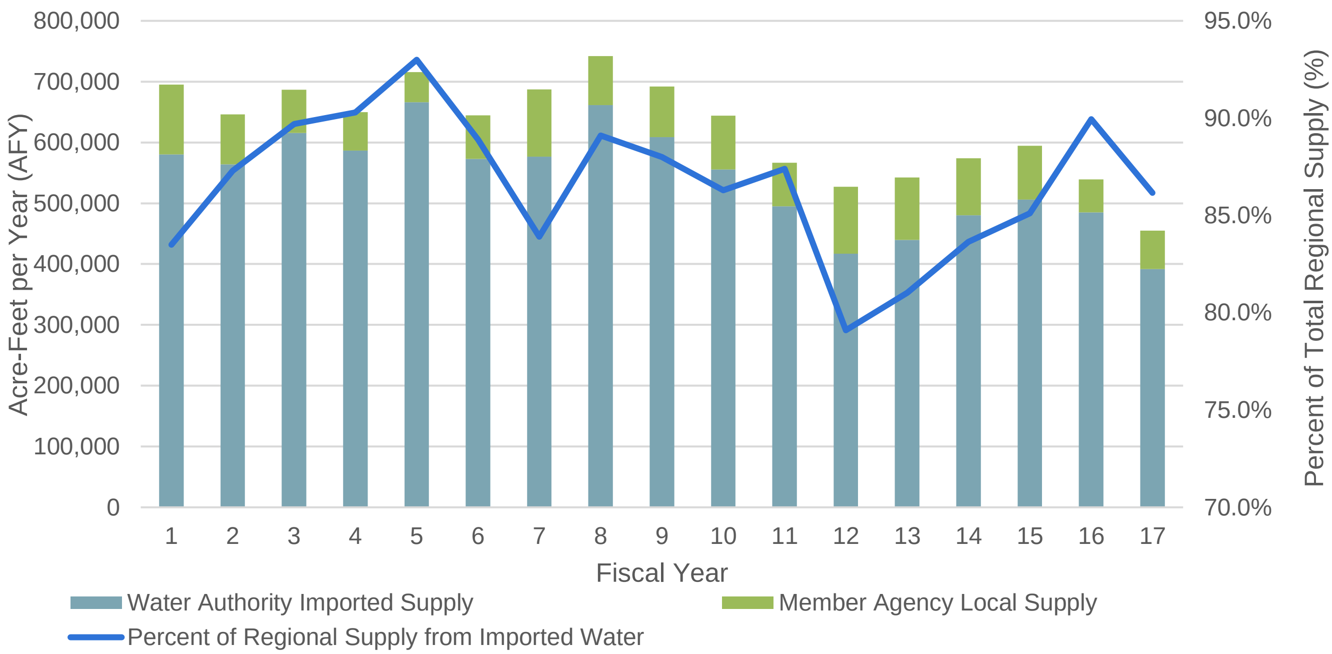
The five pipelines of the First and Second Aqueducts allow the Water Authority to take delivery of both treated (filtered and disinfected) and untreated water from Metropolitan. The Water Authority's treated water supplies come from its own Twin Oak Valley Water Treatment Plant, purchases from Metropolitan's Skinner Water Treatment Plant, and purchases from the Helix Water District's R.M. Levy Water Treatment Plant. These supplies are delivered directly to member agency potable water distribution systems. Untreated water supplies are delivered to member agency surface reservoirs or water treatment facilities.

Table 3-13: Imported Water Reliance within the Region, 1999-2016

Fiscal Year	Water Supply in Acre-feet per Year[1]			Percent of Regional Supply from Imported Water[2]
	Total Regional Supply[2]	Water Authority Imported Supply	Member Agency Local Supply[3]	
1999-2000	694,995	580,118	114,877	83.5%
2000-2001	646,387	564,140	82,247	87.3%
2001-2002	686,529	615,572	70,957	89.7%
2002-2003	649,622	586,849	62,773	90.3%
2003-2004	715,763	666,008	49,755	93.0%
2004-2005	644,845	573,048	71,797	88.9%
2005-2006	687,253	576,620	110,633	83.9%
2006-2007	741,893	661,309	80,584	89.1%
2007-2008	691,931	608,903	83,029	88.0%
2008-2009	643,900	555,789	88,211	86.3%
2009-2010	566,443	494,960	71,484	87.4%
2010-2011	526,945	416,844	110,101	79.1%
2011-2012	542,438	439,552	102,886	81.03%
2012-2013	573,901	480,048	93,853	83.65%
2013-2014	594,536	505,985	88,551	85.11%
2014-2015	539,361	485,162	54,199	89.95%
2015-2016	454,963	392,003	62,961	86.16%

1 From *Water Authority Comprehensive Annual Reports* for Fiscal Year 2015-2016(Water Authority, 2016a).
2 Regional supply provided by water agencies within the Water Authority service area. As noted in Table 3-1 all but a small fraction of the Region's population is within the Water Authority service area. Local groundwater is the source of water supply in rural areas outside the water distribution networks of the Water Authority member agencies.
3 Includes local recycled water, surface water, and groundwater supplies. Does not reflect conserved water. Also does not include groundwater pumped by private well owners.

Figure 3-5: Imported Water Reliance within the Region



Desalinated Seawater

Seawater desalination plays a key role in the region's local water supply. The Claude "Bud" Lewis Carlsbad Desalination Plant (Carlsbad Desalination Plant), owned by Poseidon Resources in a public-private partnership with the Water Authority, began operation in December 2015. The Water Authority constructed a 10-mile-long pipeline that delivers water from the plant to the Water Authority's Second Aqueduct. The Second Aqueduct then conveys desalinated water to the Water Authority's Twin Oaks Valley Water Treatment Plant, where it is blended with existing drinking water supplies for regional distribution. The Carlsbad Desalination Plant is permitted to produce up to 56,000 acre feet per year (AFY) of desalinated water and is the largest seawater desalination facility in the Western Hemisphere (see Table 3-14).

Poseidon Resources owns and operates the facility and assumes risks associated with constructing, maintaining, and operating the facility. Poseidon Resources also ensures 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. The Water Authority owns and operates the 10-mile conveyance pipeline. Two of the Water Authority's member agencies, Carlsbad Municipal Water District and the Vallecitos Water District, have agreed to purchase a total of 6,000 AFY of the desalinated water through independent purchase agreements.

The Water Authority improved its regional water delivery and treatment system to integrate desalinated water. These system improvements (see Figure 3-6) allow the Water Authority to blend the desalinated supply into treated water in Pipelines 3 and 4 of the Second Aqueduct. The Second Aqueduct then conveys desalinated water to the Water Authority's Twin Oaks WTP, where it is blended with existing drinking water supplies for regional distribution.

The Water Authority also is evaluating a potential seawater desalination project in collaboration with the U.S. Marine Corps Base Camp Pendleton. Early feasibility studies suggest potential for a seawater desalination plant that could produce 100 million to 150 million gallons per day.

Figure 3-6: Conveyance Facilities for Carlsbad Desalination Project

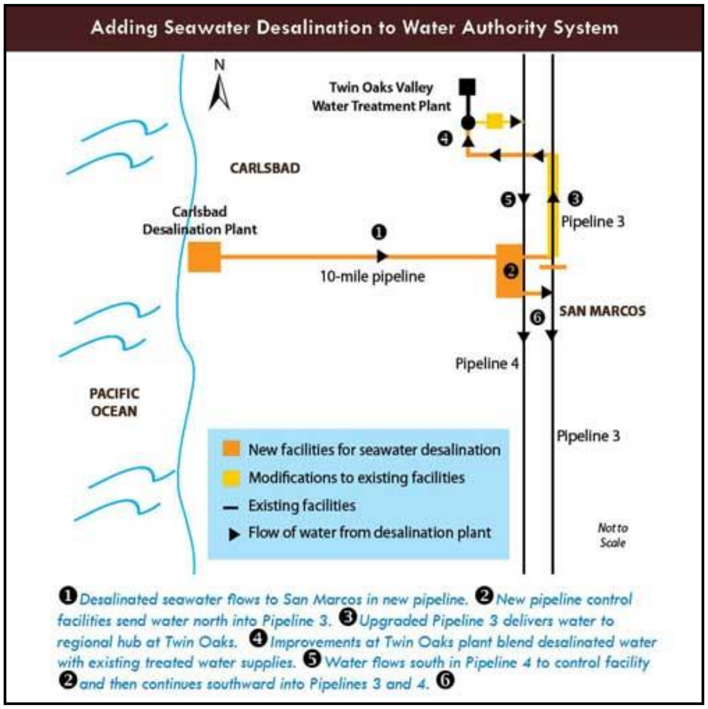


Table 3-14: Desalination Plant

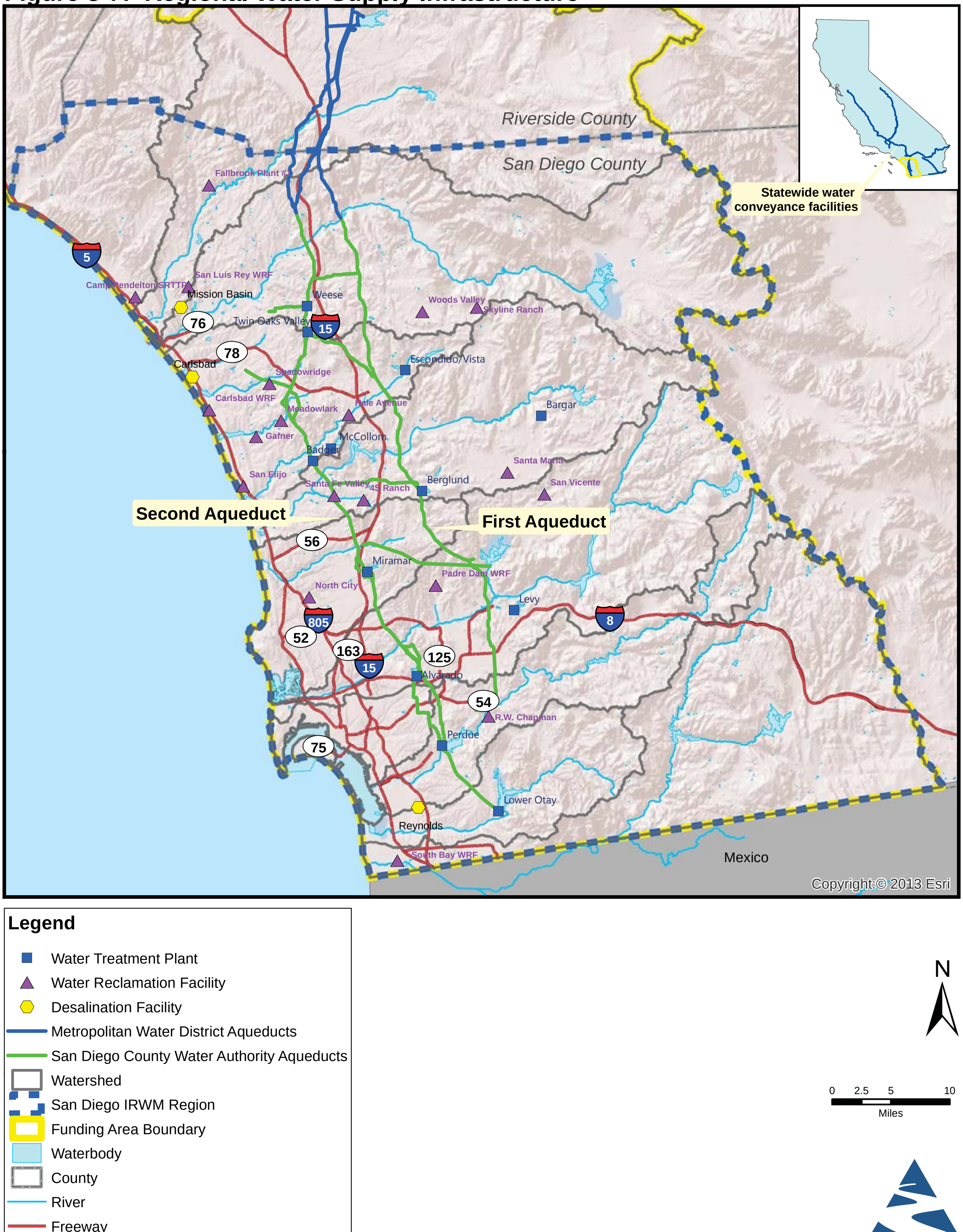
HU[1]	Watershed	Desalination Plant	Operating Agency	Capacity (AFY)	Source of Water
904	Carlsbad	Carlsbad Desalination Plant	San Diego County Water Authority	56,000	Pacific Ocean

1 Numerical watershed (hydrologic unit) designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

3.5.2 Regional Water Supply Infrastructure

Figure 3-7 presents the location of key local water supply infrastructure within the Region. The 24 surface water reservoirs located within the Region are summarized in Table 3-15. All of the reservoirs collect local stormwater and 16 are connected to the Water Authority aqueduct system and so receive imported water as well. Local water supply reservoirs exist within nine of the Region's eleven watersheds, and local surface water supplied 51,700 AF of water in 2015 (Water Authority, 2016a). In 2014, the Water Authority completed a 117-foot dam raise at San Vicente Reservoir. This raise more than doubled the reservoir's capacity, increasing it from just over 90,000 AF to nearly 250,000 AF (a 276% increase). The expanded reservoir represents over one-third of the region's total reservoir storage capacity.

Figure 3-7: Regional Water Supply Infrastructure



Source: San Diego Association of Governments (SANDAG) - GIS Data Warehouse, Metropolitan Water District
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Table 3-16 summarizes regional water treatment facilities operated by the Water Authority and its member agencies and identifies associated sources of filtration plant raw water supply.

Table 3-15: Principal Surface Water Reservoirs[1]

HU[2]	Watershed	Reservoir	Operating Agency	Capacity (Acre-Feet)	Aqueduct Connection[3]
902	Santa Margarita River	Red Mountain	Fallbrook Public Utility District	1,335	✓
		Morro Hill	Rainbow Municipal Water District	465	✓
903	San Luis Rey	Turner[5]	Valley Center Municipal Water Dist.	1,612[4]	
		Henshaw	Vista Irrigation District	51,774	
904	Carlsbad	Maerkle	Carlsbad Municipal Water District	600	✓
		Dixon	City of Escondido	2,606	✓
		Wohlford	City of Escondido	6,506	
		Olivenhain[6]	Water Authority and Olivenhain Municipal Water District	24,774	✓
		San Dieguito	San Dieguito Water District and Santa Fe Irrigation District	883	✓
905	San Dieguito	Hodges	City of San Diego	30,633	✓
		Sutherland	City of San Diego	29,508	
		Ramona	Ramona Municipal Water District	12,000	✓
		Poway	City of Poway	3,330	✓
906	Peñasquitos	Miramar	City of San Diego	6,682	✓
907	San Diego	Murray	City of San Diego	4,684	✓
		San Vicente	City of San Diego	249,358	✓
		El Capitan	City of San Diego	112,807	✓[7]
		Cuyamaca	Helix Water District	8,195	
		Lake Jennings	Helix Water District	9,790	✓
909	Sweetwater	Loveland	Sweetwater Authority	25,400	
		Sweetwater	Sweetwater Authority	28,079	✓
910	Otay	Lower Otay	City of San Diego	47,067	✓
911	Tijuana	Barrett	City of San Diego	34,806	
		Morena	City of San Diego	50,694	

1 From *2015 Urban Water Management Plan* (Water Authority, 2016).
2 Numerical watershed (hydrologic unit) designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 Bullets indicate which reservoirs are connected to the Water Authority's San Diego Aqueduct to receive untreated aqueduct water.
4 Reservoir is not currently used as a source of raw potable water supply.
5 Reservoir is out of service for maintenance and scheduled to return online in 2012.
6 Reservoir jointly owned and operated by the Water Authority and Olivenhain Municipal Water District. Reservoir is part of the Water Authority's Emergency Storage Program.
7 El Capitan Reservoir is indirectly connected, via San Vicente Reservoir, to the Water Authority's aqueduct.

Table 3-16: Potable Water Treatment Facilities[1]

HU[2]	Watershed	Treatment Facility	Operating Agency	Capacity (mgd)	Aqueduct Connection[3]
903	San Luis Rey River	Weese	City of Oceanside	25	✓
904	Carlsbad	Escondido/Vista[4]	City of Escondido Vista Irrigation District	90	✓
		Badger[5]	San Dieguito Water District Santa Fe Irrigation District	40	✓
		McCollom[5]	Olivenhain Municipal Water District	34	✓
		Twin Oaks Valley	San Diego County Water Authority	100	✓
905	San Dieguito River	Berglund	City of Poway	24	✓
		Barger	Ramona Municipal Water District	5[6]	
906	Peñasquitos	Miramar	City of San Diego	144[7]	✓
907	San Diego River	Alvarado[7,8]	City of San Diego	120	✓
		Levy	Helix Water District	106	✓
909	Sweetwater	Perdue	Sweetwater Authority	30	✓
910	Otay	Lower Otay	City of San Diego	34.2[9]	✓

1 From *2015 Urban Water Management Plan* (Water Authority, 2016b).
2 Numerical watershed (hydrologic unit) designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 Bullets indicate which treatment plants are connected to receive untreated water from the Water Authority's San Diego Aqueduct.
4 Treatment plant is physically located within the Carlsbad Watershed, but receives untreated water from Lake Henshaw (Vista Irrigation District) within the San Luis Rey River (903) watershed.
5 Treatment plant is located within the Carlsbad Watershed, but receives surface water supplies from imported water sources and from Hodges Reservoir within the San Dieguito Watershed (905).
6 The Bargar Water Treatment Plant has not been in operation since 2007 when it could not meet new requirements. In 2011 the Ramona Water District Board of Directors agreed not to pursue a plan to bring the out-of-service plant into operation during times of emergency.
7 The Miramar Water Treatment Plant has the ability to increase to 215 million gallons per day (mgd) in the future with approval from CDPH based upon results of a future treatment process study (high Filtration Rate Study) that is yet to be performed (City of San Diego, 2011).
8 Water from Sutherland Reservoir (within the San Dieguito River Watershed) can be directed to San Vicente Reservoir (within the San Diego River Watershed) (San Diego River Watershed Work Group 2005). San Vicente Reservoir is one of the sources of untreated water supply for the Alvarado Water Treatment Plant.
9 The Lower Otay Treatment Facility has the hydraulic capacity to increase to 60 mgd in the future.

Emergency Storage Program

Recognizing the Region's dependence on timely delivery of imported water supplies, the Water Authority initiated an Emergency & Carryover Storage Project (ESP) designed to provide water to the Region during imported water interruptions of up to two months of complete loss of imported supplies or six months of partial outage.

The ESP consists of storage and conveyance facilities that allow the Water Authority to maintain a 75% service level to member agencies during a prolonged interruption of imported water deliveries. ESP facilities are located in the north and east portions of the Water Authority service area and were constructed in phases. Table 3-17 summarizes existing and planned ESP facilities.

Table 3-17: Emergency & Carryover Storage Project Facilities and Schedule

Key Facilities	Facility Components and Details	Scheduled Completion
Olivenhain Dam/Reservoir, Pipeline and Pump Station	A. 318-foot tall Olivenhain Dam B. Olivenhain pipeline to connect the Olivenhain Reservoir to the Water Authority's Second Aqueduct C. Water transfer pump station	A. Completed in 2003 B. Completed in 2002 C. Completed in 2005
Hodges Reservoir Pipeline and Pump Station	A. Pipeline connecting Olivenhain Reservoir to Hodges Reservoir B. Electrical facilities to deliver power locally C. Pump station to generate power and move water between Hodges Reservoir and Olivenhain Reservoir	A. Completed in 2007 B. Completed in 2008 C. Operational in 2012
San Vicente Pipeline and Pump Station	A. 11-mile pipeline to connect the San Vicente Reservoir to the Water Authority's Second Aqueduct B. Pump station and other facilities to move water from San Vicente Reservoir to the Second Aqueduct	A. Completed in 2010 B. Completed in 2010
San Vicente Dam Raise	A. Additional 117 feet added to the existing San Vicente Dam to provide additional storage capacity for emergency use and during times of water scarcity	A. Completed in 2014
North County Pump Station	A. Pump station to move emergency water supplies to the northern-most areas of the County	A. Anticipated for completion by 2018

Hydroelectric Power Generation

Several reservoirs within the Region are operated as hydroelectric power generation facilities: the Bear Valley Facility which is connected to Lake Wohlford and operated by the City of Escondido, two facilities (Roger Miller and David C. McCollom) that are operated by the Olivenhain Municipal Water District and connected to the Olivenhain Reservoir, and a forty megawatt (40 MW) power generation facility that was constructed as part of a pumped storage project that links Olivenhain Reservoir and Hodges Reservoir.

3.5.3 Surface Water Resources

There are over 200 streams and creeks in San Diego County, converging into five primary rivers: the Santa Margarita, San Luis Rey, San Dieguito, San Diego, and Sweetwater Rivers.

Streamflow

A major element of the water cycle, streamflow refers to the flow of water in streams, rivers, and other channels. By volume, most of the surface flow in streams and rivers within the San Diego Region is from precipitation runoff (storm events). The amount of storm precipitation that becomes streamflow depends on (1) topography, land uses, and soil permeability; (2) the frequency and timing of storm events; and (3) stormwater management practices. Streamflows during non-storm periods ("dry weather flows") are the result of urban runoff, agricultural runoff, and surfacing groundwater. Dry weather flows, though small by volume, are significant in that they may carry pollutant loads and can alter the seasonal nature of aquatic and riparian habitats.

Stream gaging stations monitored as part of the USGS network currently exist in all but two of the Region's watersheds. Table 3-18 summarizes permanent streamflow monitoring stations within the region. More than 50 years of streamflow data are available from twelve of the Region's streamflow gages. Table 3-18 also presents mean and median annual streamflow at each of the existing USGS stream gaging stations.

Table 3-18: U.S. Geological Survey Surface Flow Gaging Stations

HU[1]	Watershed	No. Gaging Stations in Watershed[2]	Currently Operating Stream Gages[2]	Annual Streamflow[2] (cubic feet per sec.) Median Daily Flow	Annual Streamflow[2] (cubic feet per sec.) Mean Annual Flow	Period of Record[2]
901	San Juan	11[3]	Las Flores Creek at Las Pulgas Canyon Las Flores Creek near Oceanside San Onofre Creek at San Onofre Cristianitos Creek above San Mateo Ck. San Mateo Creek near San Clemente	0.2 0.0 0.0 0.0 0.1	1.5 1.6 1.8 3.1 11.3	1999 - 2012 1952 - 2017[4] 1947 -2010[5] 1993 - 2017 1953 - 2017[6]
902	Santa Margarita River	10[7]	Santa Margarita River at Ysidora Santa Margarita River near Fallbrook O'Neill Spillway near Fallbrook Lake O'Neill outlet near Fallbrook Lake O'Neill trib. near Fallbrook Fallbrook Creek near Fallbrook DeLuz Creek near DeLuz DeLuz Creek near Fallbrook Rainbow Creek near Fallbrook Sandia Creek near Fallbrook	7.1[8] 6.3[10] 0.0 0.4 0.0 0.3 0.3 0.0 0.33 3.5	55.9[8] 38.4[10] 0.2 1.6 0.1 1.3 10.0 4.3 3.2 8.6	1923 - 2017[9] 1924 - 2017[10] 1998 - 2017 1998 - 2017 2001 - 2005[11] 1993 - 2017 1992 - 2017 1951 - 2005[12] 1989 - 2017 1989 - 2017
903	San Luis Rey River	11	San Luis Rey River at Oceanside	2.5	34.5	1940 - 2017[13]
904	Carlsbad	1	[None currently operating]	NA	NA	NA
905	San Dieguito River	9	Santa Maria Creek near Ramona Guejito Creek near San Pasqual Santa Ysabel Creek near Ramona	0.0 0.1 0.0	6.3 2.6 9.9	1912 - 2017[14] 1946 - 2017[15] 1955 - 2017
906	Peñasquitos	10	Los Peñasquitos Creek at Poway	2.0	11.0	1964 - 2017
907	San Diego River	5	San Diego River at Fashion Valley San Diego River at Mast Blvd. Los Coches Creek near Lakeside Padre Barona Creek near Lakeside	6.0 2 0.4 0.0	36.2 24.2 1.8 1.4	1982 - 2017 1912 - 2017 1984- 2017 2005 - 2008
908	Pueblo	0	[None currently operating]	NA	NA	NA
909	Sweetwater	3	Sweetwater River near Descanso Sweetwater River near Dehesa	0.3 0.0	8.4 8.0	1957 — 2017 2006 - 2017
910	Otay	2	Jamul Creek near Jamul	0.1[16]	12.8[16]	1940 - 2017
911	Tijuana River	7	Tijuana River near Dulzura Campo Creek near Campo	0.2 0.1	1.8 3.1	1936 - 1990 1937 - 2017

1 Numerical watershed (hydrologic unit) designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
2 From USGS (2018). Many of the historical gaging stations were temporary and were operated for short periods of time as part of special streamflow investigations. Streamflow records summarized above are for gaging stations that remain in operation and for gaging stations that were discontinued in recent years.
3 All USGS stream gages within the San Juan HU (901) are within the Region.
4 Stream gage not in operation during 1978-1993.
5 Stream gage not in operation during 1968-1998. Stream gage discontinued in 2010.
6 Stream gage not in operation during 1968-1993.
7 A total of ten historic gaging stations (all currently still operational) are in the San Diego County portion of the Santa Margarita River Watershed. An additional ten historical gaging stations have existed in Riverside County within the Santa Margarita River Watershed. Seven of these stations are currently in operation, including: Santa Margarita River at Temecula (1923-present), Temecula Creek near Aguanga (1957-present), Pechanga Creek near Temecula (1987-present), Murrieta Creek near Murrieta (1997-present), Warm Springs near Murrieta (1987-present), Santa Gertrudis Creek at Temecula (1987-present), and Murrieta Creek near Temecula (1930-present).
8 Listed mean and median are for 1981-2012. Mean and median flow during 1923-1948 was 43.3 CFS and 1.6 CFS, respectively, but these flows are not equivalent to the post-1980 flows due to construction of downstream conservation ponds (see USGS, 2012).
9 Stream gage not in operation during 1975-1979 and 2000-2001.
10 A flood destroyed the original stream gage in 1980. The stream gage was relocated in 1989 to its current site near the Fallbrook Public Utility District sump. Listed mean and median streamflows are for the current gage station location (1989-2012).
11 Gaging station discontinued in 2005.
12 Stream gage not in operation during 1968-1990 and 1991-2003. Gaging station discontinued in 2006.
13 Stream gage not in operation during 1942-1946 and 1991-1993. The gaging station was also operated from 1912-1914 but flows from these years are not included in the above-listed mean and median statistics.
14 Stream gage not in operation during 1921-1946.
15 The stream gage was relocated in 1957.
16 Includes flow diverted to Jamul Creek by the City of San Diego from Barrett Reservoir (in the Tijuana River Watershed) via the Dulzura conduit. Stream gaging station not in operation from October 1978 through September 1984.

Santa Ysabel Creek just above the gorge.
Photo credit: Jeff Pasek, City of San Diego

Significant differences exist between mean and median streamflows. As previously noted, the Region is categorized as a semi-arid climate and experiences few hydrologic events that contribute to surface flows. Mean streamflow is predominantly affected by sporadic extreme hydrologic events, whereas median streamflow is more representative of daily surface runoff for the Region.

Figures 3-8 through 3-10 present mean and median monthly streamflow for three of the largest watercourses within the Region. These three watercourses generate the same trend of peak streamflow in the February to March period. The figures also show the variance of mean and median streamflow. As indicated by the monthly mean values in the figures, nearly 90% of the streamflow volume in the Santa Margarita, San Luis Rey, and San Diego Rivers occurs during the months of December through May. The majority of streamflow occurs as a result of direct stormwater runoff from a few major storm events within each rainy season. Because significant precipitation within the region typically occurs over only 30 to 60 days of the year, streamflow on most days remains low.

Table 3-19 compares pre-1975 and post-1975 summertime streamflow at the Santa Margarita, San Luis Rey, and San Diego River gaging stations. A major cause of the increase in median monthly streamflow values from pre-1975 to post-1975 can be attributed to urbanization in the watershed, which has reduced soil percolation and absorption by increasing paved surfaces, thereby increasing runoff.

While runoff directly associated with precipitation contributes most of the annual volume of streamflow, streamflow decreases substantially during the dry season. Seepage from landscape irrigation in urban areas, agricultural runoff, and surfacing groundwater are the prime sources of surface flow during non-storm (dry weather) periods. Urbanization has increased use of imported water, which is generally high in salts (total dissolved solids, or TDS), and urban runoff contributing to dry weather flows can negatively impact local surface water quality. Additionally, the availability of imported water within the Water Authority service area has resulted in reduced groundwater use in the Region's coastal areas during recent decades, increasing the amount of surfacing groundwater that contributes to streamflow in the downstream areas of the region. As shown in Table 3-19, prior to 1975, San Diego River and San Luis Rey River median streamflows during July through October were zero. Since 1975, summertime streamflows of several cubic feet per second have occurred on a sustained basis.

Figure 3-8: Mean and Median Monthly Streamflows – Santa Margarita River at Fallbrook

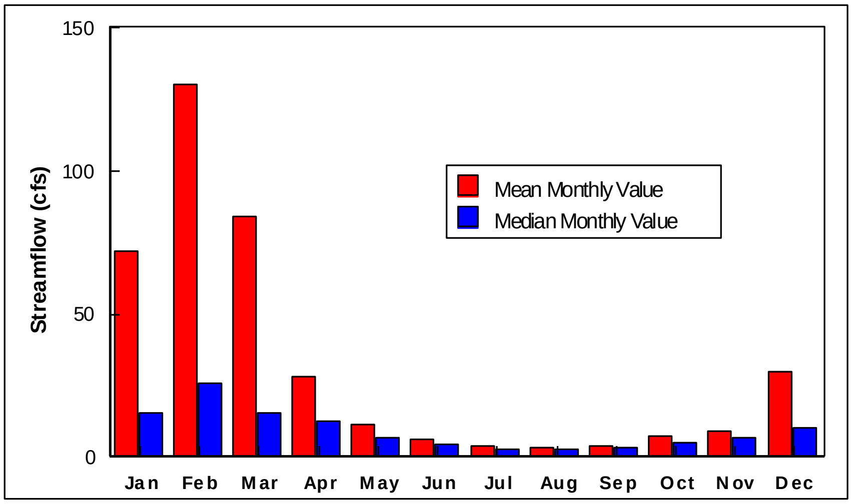


Figure 3-9: Mean and Median Monthly Streamflows – San Luis Rey River at Oceanside

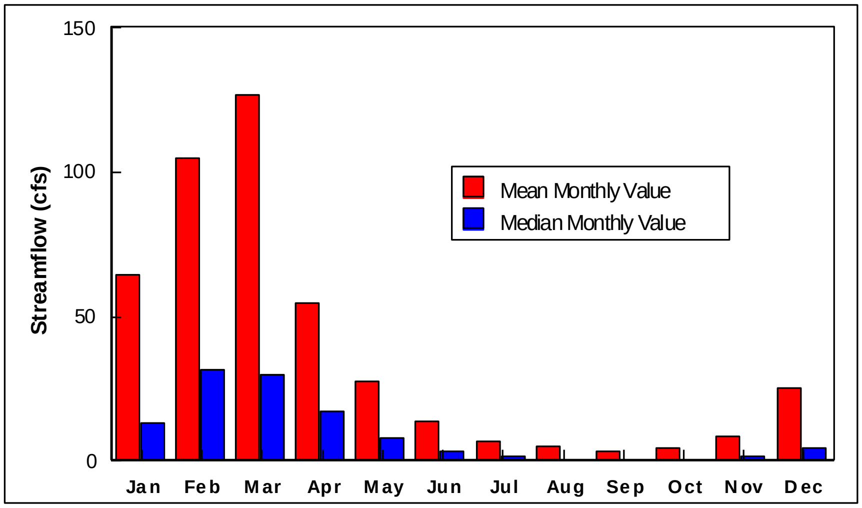


Figure 3-10: Mean and Median Monthly Streamflows – San Diego River at Mast Blvd.

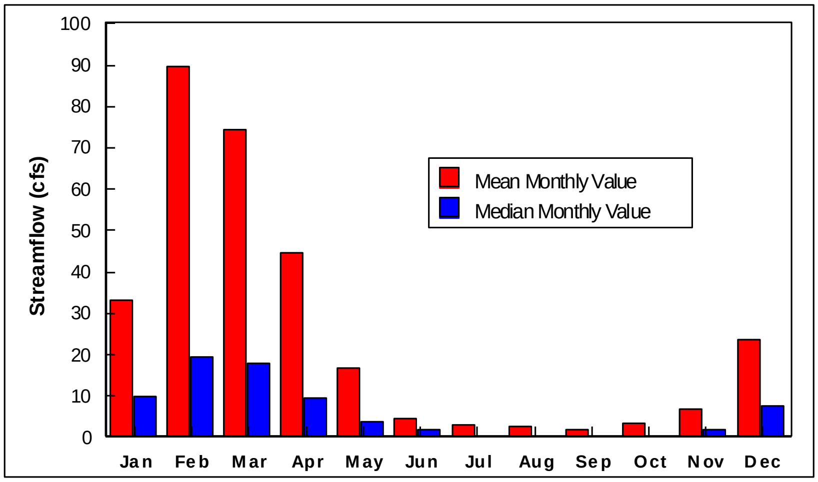


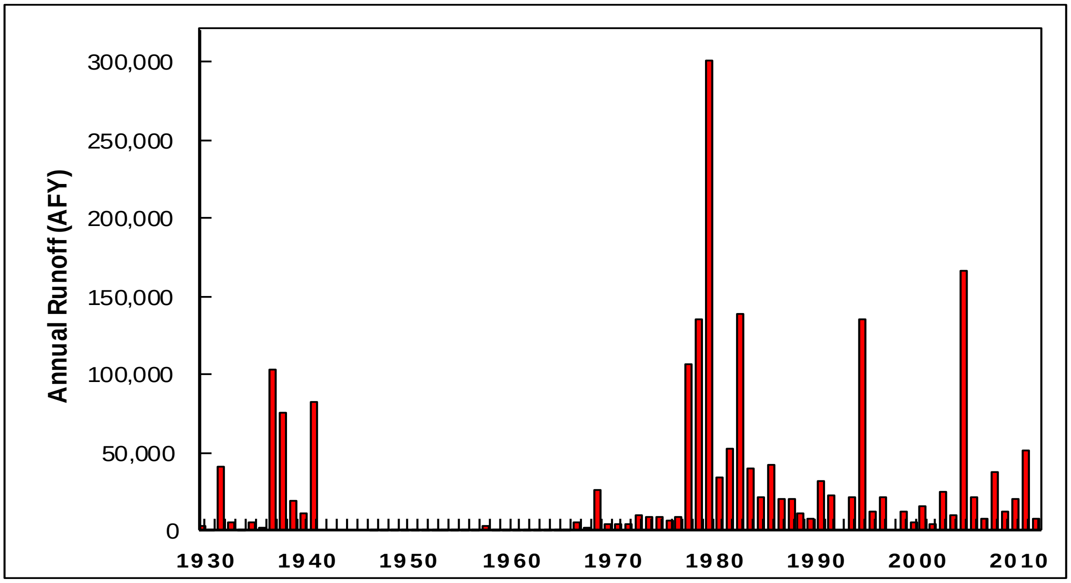
Table 3-19: Comparison of Pre-1975 and Post-1975 Median Monthly Summer Streamflow

Gaging Station	Median Monthly Summer Streamflow[1] in Cubic Feet per Second (CFS)	
	Prior to 1975	After 1975
Santa Margarita River at Fallbrook	1.5[2]	5.8[3]
San Luis Rey River at Oceanside	0.0[4]	8.6 [5]
San Diego River at Mast Boulevard	0.0[6]	6.2[5]

1 Mean of monthly streamflow values (CFS) for the summer months June through October, as reported by U.S. Geological Survey (2018).
2 Data period covering 1924 through 1974.
3 Data period covering 1989 through 2017.
4 Data period from 1929 through 1974.
5 Data period from 1975 through 2017.
6 Data period from 1912 through 1974.

Figure 3-11 presents annual runoff data for the San Luis Rey River at Oceanside that depicts the significant variation in annual runoff within the Region. While median annual runoff at the San Luis Rey River at Oceanside during 1929-2012 was 8,000 acre-feet per year (AFY), annual runoff has exceeded 100,000 AFY during seven years of the period of record. A total of 54% of the San Luis Rey River runoff during 1929-2012 occurred during these seven years.

Figure 3-11: Annual Runoff - San Luis Rey River at Oceanside



Coastal Waters

Each of the Region's eleven watersheds features coastal water resources that support wildlife habitat, endangered species, and recreational uses (see Appendix 3-A for a list of the designated beneficial uses of Region coastal waters).

The Region's coastal water resources represent a unique resource, and the Region features more coastal lagoons than any comparably-sized area in California. Eight of the Region's watersheds discharge to the following estuaries or brackish coastal lagoons:

- San Mateo Lagoon, San Onofre Lagoon, and Las Flores Lagoon (San Juan Watershed),
- Santa Margarita River Estuary (Santa Margarita River Watershed),
- San Luis Rey River Estuary (San Luis Rey River Watershed),
- Loma Alta Slough, Batiquitos Lagoon, Buena Vista Lagoon, Agua Hedionda Lagoon, and San Elijo Lagoon (Carlsbad Watershed),
- San Dieguito Lagoon (San Dieguito River Watershed),
- Los Peñasquitos Lagoon (Peñasquitos Watershed),
- San Diego River Estuary (San Diego River Watershed), and
- Tijuana River Estuary (Tijuana River Watershed).

A portion of the Peñasquitos Watershed (Rose and Tecolote Creeks) discharges to Mission Bay, a widely used regional recreational asset. Three watersheds (Sweetwater, Otay, and a portion of the Pueblo) discharge to San Diego Bay, an important regional commercial and recreational asset. Additionally, some of these watersheds include transitional wetlands at their outlets, and many of these wetlands are part of local, regional, or national refuges and wildlife areas.

State Board Resolution No. 74-28 requires Regional Water Quality Control Boards to designate coastal waters as Areas of Special Biological Significance (ASBS) if the waters contain "biological communities of such extraordinary, even though unquantifiable, value that no acceptable risk of change in their environment as a result of man's activities can be entertained."

The Basin Plan designates two ASBS within the Region, both of which are coastal waters of the Peñasquitos Watershed:

- La Jolla Ecological Reserve Area, and
- San Diego Marine Life Refuge Area.

Numerous recreational beaches, recreational areas and ecologic reserves (see *Sections 3-8* and *3-9*) exist within the Region's eleven watersheds.

3.5.4 Wastewater

The Region produces approximately 200 million gallons per day (mgd) of wastewater, which is treated at one of 32 wastewater treatment or water reclamation facilities. Wastewater is typically treated to secondary standards prior to ocean discharge, or to tertiary levels if intended for distribution for non-potable use. The processes through which wastewater is treated to higher levels and reused are discussed further in *Section 3.5.5*. Table 3-20 shows the permitted treatment capacity of wastewater and recycled water facilities in the Region.

Table 3-20: Wastewater and Recycled Water Treatment Facilities

HU[1]	Watershed	Agency	Name of Treatment Facility	Permitted Secondary Treatment Capacity (mgd)	Permitted Tertiary Treatment Capacity (mgd)	Recycled Water Use in 2015[2] (acre-feet)
902	Santa Margarita	Camp Pendleton	Northern Regional TTP		2.4[44]	450
		Camp Pendleton	STP 9	0.7[4]		
		Camp Pendleton	STP 11	3.15[5]		148[42]
		Camp Pendleton	STP 12	0.35[6]		148[42]
		Rainbow Municipal Water District	Oak Crest Mobile Estates	0.012[7]		
		California Department of Forestry and Fire Protection (CalFire)	Rainbow Conservation Camp	0.0125[8]		
903	San Luis Rey	Camp Pendleton	Southern Regional TTP		3.6[3]	450
		City of Oceanside	San Luis Rey	13.5[9]	0.7[9]	130
		Fallbrook Public Utility District	Plant No. 1		2.7[10]	600
		Valley Center Municipal Water District	Woods Valley Ranch		0.275[11]	47
		Valley Center Municipal Water District	Lower Moosa Canyon	1[12]		
		Skyline Ranch Country Club, LLC	Skyline Ranch	0.055[13]		
		Pauma Valley Community Service District	Pauma Valley	0.15[14]		
904	Carlsbad	Buena Sanitation District/City of Vista	Shadowridge[8]		1.16[15]	0[15]
		Carlsbad Municipal Water District	Carlsbad		7.0[16]	1,903
		Leucadia Wastewater District	Gafner		1.0[17]	247
		Vallecitos Water District	Meadowlark		5.0[18]	2,358
		City of Escondido	Hale Avenue		6.4[19]	3,900
		County of San Diego/Rincon Del Diablo Municipal Water District	Harmony Grove		0.54[43]	
		San Elijo Joint Powers Authority	San Elijo	5.25[20]	2.48[20]	1,470
		City of Oceanside	La Salina	5.5[21]		
		Encina Wastewater Authority	Encina	40.5[22]		
905	San Dieguito River	Olivenhain Municipal Water District	4-S Ranch		2.0[23]	915
		Ramona Municipal Water District	Santa Maria	1.0[24]	0.35[24]	230
		Rancho Santa Fe Community Services District	Santa Fe Valley		0.485[25]	140
		Rancho Santa Fe Community Services District	Rancho Santa Fe	0.45[26]		

HU[1]	Watershed	Agency	Name of Treatment Facility	Permitted Secondary Treatment Capacity (mgd)	Permitted Tertiary Treatment Capacity (mgd)	Recycled Water Use in 2015[2] (acre-feet)
		Whispering Palms Community Services District	Whispering Palms	0.2[27]		
		Fairbanks Community Services District	Fairbanks Ranch	0.275[28]		
		County of San Diego	San Pasqual Academy	0.05[29]		
906	Peñasquitos	City of San Diego	North City		32.0[30]	8,045
		City of San Diego	Metropolitan Biosolids Center	N/A[31]		
907	San Diego River	Padre Dam Municipal Water District	Ray Stoyer		2.0[32]	2,016
		Ramona Municipal Water District	San Vicente		0.75[33]	480
		County of San Diego	W.S. Heise Park	0.018[34]		
		County of San Diego	Julian	0.04[35]		
908	Pueblo	City of San Diego	Point Loma	240[36]		
910	Otay River[19]	Otay Water District	R.W. Chapman		1.3[37]	1,100
911	Tijuana River	City of San Diego	South Bay	15[39]	15.0[39]	4,466
		International Boundary and Water Commission	South Bay International	25[40]		
		County of San Diego	Pine Valley	0.04[41]		

1 Numerical watershed (hydrologic unit) and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
2 Recycled water use for year 2015 as reported by member agencies in *2015 Urban Water Management Plan* (Water Authority, 2016a). Reporting criteria for recycled water use may vary on an agency-by-agency basis.
3 Permitted tertiary treatment capacity per San Diego Water Board Order No. R9-2013-0112.
4 San Diego Water Board Order No. 98-04
5 San Diego Water Board Order No. 97-13
6 San Diego Water Board Order No. 98-05
7 San Diego Water Board Order No. 93-69
8 San Diego Water Board Order No. R9-2009-0009
9 The San Luis Rey facility is permitted to discharge 13.5 mgd secondary effluent, or up to 15.4 mgd with written approval from the San Diego Water Board in accordance with its discharge permit. San Diego Water Board Order No. R9-2011-0016 as amended by R9-2012-0042.
10 San Diego Water Board Order No. R9-2012-0004.
11 San Diego Water Board Order No. R9-2015-0104. The listed recycled water use for 2010 does not include 336 acre-feet of secondary effluent from the Lower Moosa Canyon Water Reclamation Facility that is discharged to percolation ponds.
12 San Diego Water Board Order No. 95-32, as amended
13 San Diego Water Board Order No. R9-2005-0258
14 San Diego Water Board Order No. R9-2006-0049
15 San Diego Water Board Order No. 93-82 and Addenda Nos. 1 and 2. Facility is currently not in operation. Due to high production costs, the City of Vista suspended operations of the facility in 2003. A feasibility study was completed in 2009 to evaluate the feasibility upgrading the facility.
16 San Diego Water Board Order No. R9-2016-0183.
17 San Diego Water Board Order No. R9-2004-0223.
18 San Diego Water Board Order No. R9-2007-0018. Recycled water from the Meadowlark Water Reclamation Facility is purveyed by Carlsbad Municipal Water District and Olivenhain Municipal Water District.
19 San Diego Water Board Order No. R9-2015-0026. Recycled water from the Hale Avenue facility is purveyed by the City of Escondido and Rincon Del Diablo Municipal Water.
20 San Diego Water Board Order No. R9-2010-0087. Recycled water from the San Elijo facility is purveyed by the Santa Fe Irrigation District, San Dieguito Water District, and City of Del Mar.
21 San Diego Water Board Order No. R9-2011-0016 as amended by R9-2012-0042
22 The Encina Wastewater Pollution Control Facility is permitted to produce secondary water (up to 40.5 mgd), but sells up to 5 mgd of this to Carlsbad WRF (4 mgd) and Gaftner WRF (1 mgd) for tertiary treatment. San Diego Water Board Order No. R9-2011-0019
23 San Diego Water Board Order No. R9-2003-0007.
24 San Diego Water Board Order No. R9-2016-0154.

HU[1]	Watershed	Agency	Name of Treatment Facility	Permitted Secondary Treatment Capacity (mgd)	Permitted Tertiary Treatment Capacity (mgd)	Recycled Water Use in 2015[2] (acre-feet)

25 San Diego Water Board Order No. R9-2002-0013.
26 Rancho Santa Fe Community Services District (http://www.rsfcsd.com/aboutus.html), Accessed August 29, 2013.
27 San Diego Water Board Order No. 94-80
28 San Diego Water Board Order No. 93-05, as amended
29 San Diego Water Board Order R9-2009-0072
30 San Diego Water Board Order No. R9-2015-0091. Recycled water use per City of San Diego 2015 UWMP. Recycled water from the North City Water Reclamation Plant is purveyed by Olivenhain Municipal Water District, the City of Poway and City of San Diego.
31 The Metro Biosolids Center is a solids handling facility, dewatering sludge produced by North San Diego and Point Loma wastewater treatment facilities. As such, it does not have a permitted capacity.
32 San Diego Water Board Order No. 97-49 (recycled water irrigation) and Order No. R9-2016-0099, NPDES CA0107492 (lake replenishment). Recycled water is for replenishing Santee Lakes.
33 San Diego Water Board Order No. R9-2009-0005.
34 San Diego Water Board Order No. 93-09
35 San Diego Water Board Order No. 83-09, as appended
36 Point Loma is permitted to treat to Advanced Primary rather than Secondary. San Diego Water Board Order No. R9-2017-0007
37 Plant is located in Sweetwater Watershed, but recycled water use is in Otay Watershed. San Diego Water Board Order No. 92-25 and Addendum No. 1.
38 San Diego Water Board Order No. 93-112. However, this permit was rescinded in 2010.
39 Plant can discharge a total of up to 15 mgd, either secondary, tertiary, or some combination of the two. San Diego Water Board Order No. R9-2017-0023; San Diego Water Board Order No. 2000-203 and Addenda Nos. 1 and 2. Recycled water use per City of San Diego 2010 UWMP.
40 San Diego Water Board Order No. R9-2017-0024.
41 San Diego Water Board Order No. 94-161
42 Camp Pendleton reported the use of 148 AFY of secondary recycled water for percolation/seawater intrusion barrier in 2015. However, STP #11 and STP #12 have been replaced by the Southern Regional TTP.
43 San Diego Water Board Order No. R9-2012-0054.
44 San Diego Water Board Order No. R9-2014-0006.

Wastewater in the Region may undergo four levels of treatment. Primary treatment removes heavy solids through settling by gravity. Advanced primary treatment further removes solids using chemicals that cause clumping of smaller solids to allow solids to settle out of water for removal. Secondary treatment uses primary-treated water, and subjects it to biological treatment, wherein microbes are used to break down biological substances. Tertiary treatment filters secondary effluent through a medium such as cloth or sand/disinfection to reduce total dissolved solids (TDS) and other water quality impairments. Multiple agencies across the Region are in the process of constructing advanced water treatment (AWT) facilities to supplement existing recycled water supplies, including the Cities of San Diego's and Oceanside's Pure Water programs and Padre Dam Municipal Water District's Advanced Water Purification Program, discussed further in *Section 3.5.5 Water Reuse*.

The Region treats approximately 100 mgd of wastewater to primary standards, 100 mgd to secondary standards, and anticipates treating 70 mgd to tertiary standards by 2020. Planned projects would increase the Region's secondary and tertiary capacities to 270 mgd, and 230 mgd, respectively, by 2045 (Water Authority, 2016a). Water that is not treated to tertiary levels and reused as recycled water is discharged through one of the Region's five deep-water ocean outfalls, summarized in Table 3-21 and shown in Figure 3-12. As shown, there are four primary sewersheds within the Region – a sewershed is the area of land from which wastewater is collected and conveyed to a treatment facility. These sewersheds are:

1) the area that conveys wastewater to the Oceanside Ocean Outfall,
2) the area that conveys wastewater to the Encina Ocean Outfall,
3) the area that conveys wastewater to the San Elijo Ocean Outfall, and

4) the area that conveys wastewater from the Metropolitan (Metro) Wastewater System, including the Point Loma Ocean Outfall and the South Bay Ocean Outfall.

Please note that the Metro Wastewater sewershed (indicated in blue on Figure 3-12) conveys wastewater to both the Point Loma Ocean Outfall and the South Bay Ocean Outfall; however, the source of wastewater that is conveyed to each facility varies on a day-to-day basis depending on wastewater flow availability and various operational parameters.

In addition to providing means for wastewater and recycled water disposal, the outfalls can also be used as a salinity management asset. Four of the regional municipal wastewater outfalls are currently being used for disposal of saline or brackish water, including:

- Oceanside Ocean Outfall is used for disposal of demineralization brine from the City of Oceanside's groundwater desalter and demineralization brine from a local industry, as well as brine from Camp Pendleton's advanced water treatment RO system,
- Encina Ocean Outfall is used for the disposal of demineralization brine from the City of Carlsbad Water Reclamation Facility when demineralization facilities are operational,
- San Elijo Ocean Outfall is used for disposal of brackish cooling tower water from the Palomar Energy Plant in Escondido via the City of Escondido Industrial Brine Collection System, and demineralization brine from the San Elijo Joint Powers Authority Water Reclamation Facility, and
- Point Loma Ocean Outfall is used for disposal of demineralization brine from the City's North City Water Reclamation Plant.

Table 3-21: Municipal Wastewater Ocean Outfalls[1]

HU[2]	Name	Outfall	Operating Agency	Discharge Distance Offshore (ft)	Permitted Discharge Flow (mgd)	Agencies Served
903	San Luis Rey River	Oceanside	City of Oceanside	8,050	22.9[3]	City of Oceanside
					3.6[4]	USMC Base Camp Pendleton
					2.4[5]	Fallbrook Public Utility District
904	Carlsbad	Encina	Encina Wastewater Authority	7,800	43.3[6]	Encina Wastewater Authority[7]
		San Elijo	San Elijo Joint Powers Authority[8]	8,000	18.0[9]	City of Escondido
					5.25[10]	San Elijo JPA[11]
908	Pueblo	Point Loma	City of San Diego	23,470	240[12]	San Diego Metropolitan Sewerage System[13]
911	Tijuana River	South Bay	City of San Diego[16]	23,600	15[14]	San Diego Metropolitan Sewerage System [13,15]
					25[17]	U.S. Boundary and Water Commission[17]

1 Compiled from adopted recycled water discharge permits adopted by the San Diego Water Board. See footnotes below.
2 Numerical watershed (hydrologic unit) and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 City of Oceanside per San Diego Water Board Order No. R9-2009-0016, NPDES CA0107433. The permitted discharge is the combined discharge from the San Luis Rey Water Reclamation Facility, La Salina Wastewater Treatment Plant and waster brine from the Mission Bay Desalting Facility.
4 U.S. Marine Corps Base Camp Pendleton per San Diego Water Board Order No. R9-2012-0041 and Addendum No. 1, NPDES CA0109347.
5 Fallbrook Public Utility District per San Diego Water Board Order No. R9-2012-0004, NPDES CA0108031.
6 Encina Wastewater Authority per San Diego Water Board Order No. R9-2011-0019, NPDES CA0107395. The permitted discharge is the combined discharge from the Encina Water Pollution Control Facility, Meadowlark Water Reclamation Plan, Shadowridge

Water Reclamation Plant and Carlsbad Water Reclamation Facility
7 Encina Wastewater Authority member agencies include Buena Sanitation District, City of Carlsbad, City of Encinitas, Leucadia County Water District, Vallecitos Water District, and City of Vista.
8 The San Elijo Ocean Outfall is jointly owned by the City of Escondido and San Elijo Joint Powers Authority.
9 City of Escondido per San Diego Water Board Order No. R9-2010-0086, NPDES CA0107981.
10 San Elijo Joint Powers Authority per San Diego Water Board Order No. R9-2010-0087, NPDES CA0107999.
11 San Elijo Joint Powers Authority member agencies include the City of Solana Beach and City of Encinitas.
12 Point Loma Ocean Outfall per San Diego Water Board Order No. R9-2009-0001, NPDES CA0107409.
13 The City of San Diego serves as operating agency for the San Diego Metropolitan Wastewater System (Metro System). The Metro System serves the following agencies: City of Coronado, City of Chula Vista, City of Del Mar, City of El Cajon, City of Imperial Beach, City of La Mesa, City of National City, City of Poway, City of San Diego, Lemon Grove Sanitation District, Padre Dam Municipal Water District, Otay Water District, Lakeside/Alpine Sanitation District, Spring Valley Sanitation District, East Otay Sewer Maintenance District and Winter Gardens Sewer Maintenance District.
14 South Bay Ocean Outfall per San Diego Water Board Order No. R9-2013-0006, NPDES CA0109045.
15 Metro System member agencies tributary to the South Bay Ocean Outfall include the City of San Diego, City of Imperial Beach, and City of Chula Vista.
16 South Bay Ocean Outfall is jointly owned by the City of San Diego and the U.S. Government (International Boundary and Water Commission).
17 IBWC South Bay International Treatment Plant that treats up to 25 mgd of wastewater from Tijuana, Mexico. The IBWC discharge to the South Bay Ocean Outfall is regulated by San Diego Water Board Order No. 95-50 (NPDES CA0108928) and Cease & Desist Order No. 96-52.

For communities or individuals who are not served by a wastewater agency or sanitary district, wastewater is disposed of and treated through on-site septic systems. Septic systems can be effective wastewater treatment systems when properly sized, sited, and maintained and are more likely to be found in rural areas, though can be found occasionally in urbanized areas that were formerly rural and did not convert to sewer. When improperly sized, sited, or maintained, septic systems can fail, and pose public health risks including surfacing of wastewater and impacts to groundwater quality.

3.5.5 Water Reuse

> *Since its inception, the IRWM Program has provided over $33 million to a variety of water reuse projects. In total, approximately 40% of San Diego's IRWM implementation grant funding has been awarded to water reuse projects.*

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. 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. Although potable reuse is not currently part of the Region's water supply, it is being actively pursued in the Region, with potable reuse projects anticipated to begin deliveries by 2020 (Water Authority, 2016).

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.

Non-Potable Reuse

During 2015, Water Authority member agencies reported the reuse of approximately 29,000 AF of non-potable recycled water. The use of non-potable recycled water within the Region is projected to increase to approximately 47,000 AFY by 2040 (Water Authority, 2016a).

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, fire suppression, 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 current recycled water is predominantly 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 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.

Figure 3-12 presents the location of all wastewater and recycled water infrastructure within the Region. Table 3-20 summarizes the Region's existing wastewater and water recycling facilities and indicates which of the Region's water reclamation plants are capable of treating water to tertiary standards for non-potable reuse.

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. In addition, recycled water supplies are less sensitive to temporal and seasonal variability, as well as external forces, as compared to imported water, supporting the Region's local water supply reliability goals.

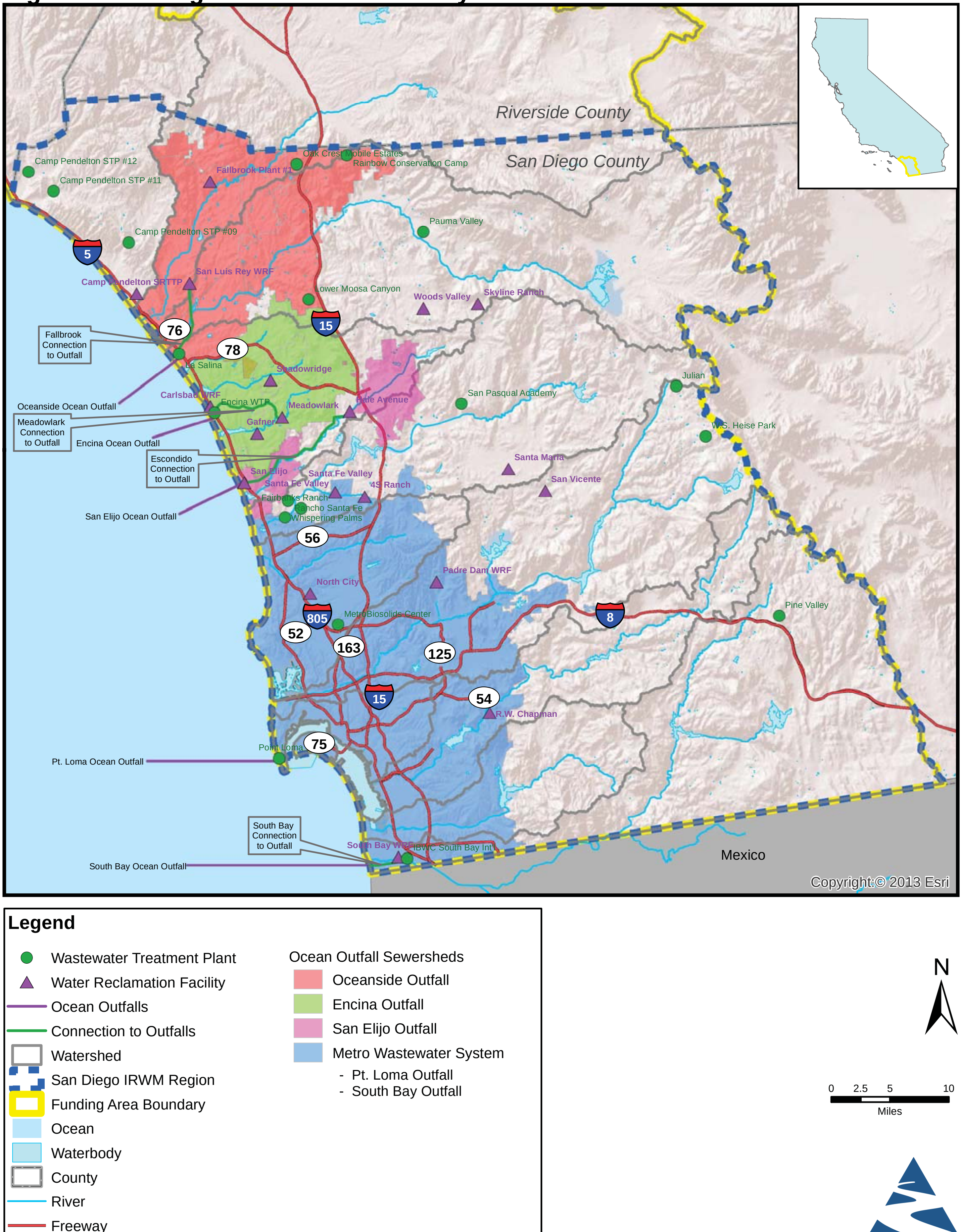
Despite the cost and energy savings associated with non-potable reuse, it also requires additional work by the local water agency, thus additional cost, for regulatory compliance. Because tertiary treated recycled water is a non-potable resource, it must be segregated from potable water and delivered through a separate distribution system. While such facilities may exist for potable water, separate infrastructure must be constructed and operated for recycled water, and there must be infrastructure and agency programs to ensure that the non-potable recycled water does not mix with potable water. This recycled water distribution system is commonly referred to as the "purple pipe" system. The purple pipe system includes not only pipelines, but also all other water conveyance infrastructure such as pumps, valves, and storage tanks. Additionally, higher levels of TDS in recycled water compared to potable water can lead to accelerated corrosion, requiring more frequent infrastructure replacement than in potable systems or use of demineralization facilities to reduce salinity, which adds cost to system operations.

The IRWM Program has been supportive of expanding non-potable reuse in the Region by funding treatment plant improvements, distribution system expansions, inter-connections, use site retrofits, and outreach to educate customers on the benefits of non-potable reuse.

Recycled water is used primarily for irrigation.

Photo credit: City of San Diego

Figure 3-12: Regional Wastewater/Recycled Water Infrastructure



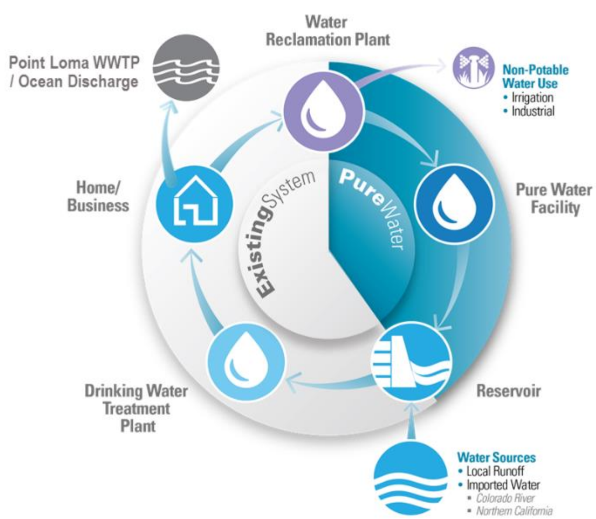
Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\AdminDraftMaps\060713_JD\Fig3-10_Regional WW RW Infra 060713.mxd

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 involves advanced treatment of tertiary-quality recycled water to produce purified water, which would be similar in quality to distilled water (City of San Diego, 2013a). 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. The State Board is responsible for regulating potable reuse projects through DDW, which regulates drinking water supplies, and its nine Regional Water Quality Control Boards, which regulate surface water and groundwater discharges. Potable reuse may either be indirect or direct; each will be subject to different regulations. Indirect potable reuse (IPR) involves discharging advanced treated water into an environmental buffer, such as a large reservoir or groundwater basin, where it must have a minimum of a six-month residence time before extraction for treatment at a drinking water treatment plan.

Direct potable reuse (DPR) eliminates the environmental buffer requirement, though advanced treated water is still incorporated into the raw water supply and treated again at a drinking water treatment plant. Draft regulations for DPR are still in development by DDW[1], and such systems cannot yet be permitted. Several local agencies are actively pursuing potable reuse.

Six of the Region's water supply agencies are currently completing studies and pilot programs pertaining to potable reuse via groundwater recharge or reservoir augmentation:



City of San Diego's Pure Water Project

1. The **City of San Diego** has been exploring potable reuse for over a decade as a way to supplement local supplies and offload wastewater flows to the Point Loma WWTP, whose location makes it challenging to expand as the region grows. Pure Water San Diego is the City of San Diego's phased, multi-year program to use proven water purification technology to clean recycled water to produce purified water that meets state and federal drinking water standards. The project's long-term goal is to produce 83 mgd (93,013 AFY), or one-third of San Diego's future drinking water supply, by 2035. Phase 1 of the Pure Water Program will produce 30 mgd starting in 2023 and utilize surface water augmentation, with Miramar Reservoir serving as the environmental buffer. While originally conceived to utilize San Vicente Reservoir, Miramar Reservoir provides cost saving by reducing conveyance pipelines

[1] See State Board DDW's website on potable reuse regulations: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RW_SWA_DPRexpertpanel.html

from 28 miles to 8 miles, has fewer environmental impacts, and can use renewable energy to satisfy pumping demands (City of San Diego, 2017).

2. The **City of Oceanside** completed the investigative phase of their Pure Water Oceanside, which involves recharging of the Mission Groundwater Basin using water advanced treated at the San Luis Rey Water Reclamation Facility (SLRWRF). The project will be implemented in two phases, with a final capacity of 4.5 mgd, which will provide an ultimate yield of 3,300 AFY of groundwater recharge. This project will be operational in 2020.
3. **Padre Dam MWD** received IRWM funding under Proposition 84 Round 4 Implementation Grant for their East County Advanced Water Purification Program (East County AWP). The project will expand the Ray Stoyer WRF by 4 mgd to deliver recycled water for irrigation and to deliver tertiary effluent to the Advanced Water Purification Facility, allowing for potable reuse. This project is the first step in the East County AWP, which is projected to begin delivering 3,920 AFY potable reuse supplies in 2020, with an ultimate goal of delivering 11,536 AFY potable reuse by 2025. Padre Dam MWD is also considering later expansion by an additional 5,824 AFY, though this third phase is still conceptual only (Water Authority, 2016a).
4. **Rincon Del Diablo MWD** is exploring potable reuse opportunities, with a goal of 1,000 AFY potable reuse by 2030 (Water Authority, 2016a). After exploring potable reuse using a groundwater basin as the environmental buffer, Rincon Del Diablo MWD found that option to be infeasible, and is currently considering partnering with the City of Escondido for possible surface water augmentation or even direct potable reuse via a scalping plant from the Hale Avenue Resource Recovery Facility's (HARRF's) outfall once the State issues final guidance for DPR and Rincon Del Diablo MWD is approved as a sewer agency by the San Diego Local Agency Formation Commission (LAFCO) (Rincon Del Diablo, 2016)
5. The **City of Escondido** is considering implementing potable reuse at HAARF, though it's still in the conceptual phase. Should the City move forward with this project, it anticipates ultimate delivery of 5,000 AFY potable reuse water.
6. **Olivenhain MWD** is also considering potable reuse, with a goal of 560 AFY potable reuse through groundwater recharge with advanced treated wastewater from San Elijo JPA (Water Authority, 2016a).

Potable reuse can provide multiple water management benefits to the Region. It would further diversify the Region's water supplies and achieve environmental objectives by reducing wastewater discharges to the ocean. Investing in potable reuse would be a more efficient investment than solely focusing on upgrades to wastewater systems because it helps toward two goals – water supply and wastewater management (refer to the comment letter from the Metro JPA Technical Advisory Committee in Appendix 6-D). Savings from offloading wastewater systems could reduce water supply costs to consumers by $1,000 per AF (City of San Diego, 2013a). Potable reuse would also reduce the cost of higher salinity to utilities and consumers through water quality improvements associated with advanced water treatment. Because purified water has TDS levels much lower than the existing imported water (about 15 mg/L compared to 500 mg/L), blending of the two supplies will reduce overall salinity. Operations and maintenance costs associated with corrosion would be substantially reduced in the potable water system for consumers. The savings from reduced TDS has been estimated at $100 per AF (City of San Diego, 2012). Additionally, potable reuse allows the same drop of water to be reused multiple times, versus non-potable reuse, because it reenters the wastewater treatment stream after use, whereas non-potable reuse is discharged to the environment and has limited opportunities for capture and reuse.

The IRWM Program has funded several projects to conduct important research that will advance the opportunities to reuse our water. This will lead to the opportunity to further integrate the Region's water supply and wastewater management efforts and achieve multiple benefits.

The City of San Diego is Testing the Feasibility of Potable Reuse at its Advanced Water Purification Demonstration Facility

Photo credit: Goldy Herbon, City of San Diego

The City of San Diego has been studying potable reuse using reservoir augmentation since the 1990s, recently with the Water Purification Demonstration Project. The Water Purification Demonstration Project, which began in 2007 and was completed in 2012, consisted of installation and operation of a 1 mgd demonstration-scale Advanced Water Purification Facility, studies of San Vicente Reservoir, education and outreach, and assessments of regulations, energy use, and costs; all with oversight by an Independent Advisory Committee. The results of the Water Purification Demonstration Project allowed CDPH to issue a letter of conceptual regulatory approval for the City's proposed 15 mgd potable reuse project using San Vicente Reservoir. Similarly, in a 2012 resolution the San Diego Water Board expressed support of the City's proposed potable reuse projects, and in 2013 the San Diego Water Board issued a letter validating the proposed regulatory pathway for a project at San Vicente Reservoir (City of San Diego, 2013a).

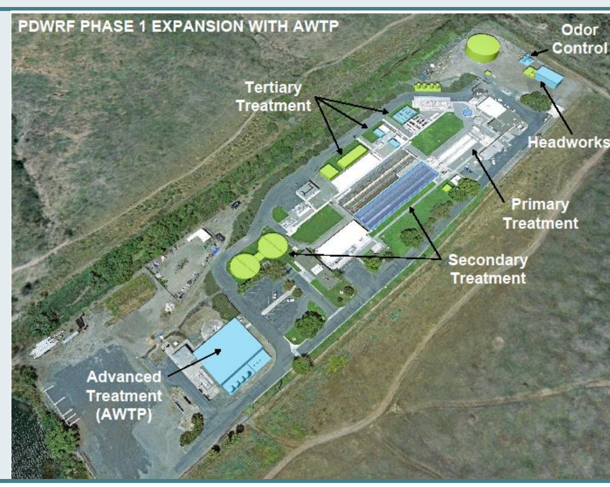
The City of San Diego's proposals to augment drinking water supplies through potable reuse has support of residents: in a 2012 poll of City residents, 73% of respondents strongly favored or somewhat favored using advanced treated recycled water as an addition to the Region's drinking water supply (City of San Diego, 2013a).

The City of San Diego is also investigating options for Direct Potable Reuse (DPR). The City has teamed with the WateReuse Foundation to conduct additional research at the Advanced Water Purification Facility to test treatment and monitory technologies. The City's Advanced Water Purification Facility is ideal for this research because it uses full-scale components, and the water produced can be returned to the purple pipe system. DPR is an emerging concept – there is currently no regulatory framework for DPR projects in California. The results of these on-going projects will support establishing regulatory guidelines for DPR. Continuing tours and education at the facility will further public understanding of the health and safety aspects of potable reuse.

The City's potable reuse initiatives are supported by grant funding from the San Diego IRWM Program.

Padre Dam Municipal Water District, Padre Dam Advanced Water Treatment – Phase IA Expansion

Padre Dam Municipal Water District will expand the Ray Stoyer Water Reclamation Facility by 4 mgd to deliver recycled water for irrigation, and to deliver tertiary effluent to the Advanced Water Purification Facility, to allow for future potable reuse. This project helps to move Padre Dam MWD and Helix Water District towards potable reuse, supporting the Region's goal of supply reliability and sustainability.



3.5.6 Groundwater Resources

The San Diego IRWM Region contains 22 separate groundwater basins, as defined by the California Department of Water Resources (DWR) Bulletin 118 (DWR, 2003 and 2016). These groundwater basins are:

- San Mateo Valley
- San Onofre Valley
- Santa Margarita Valley
- San Luis Rey Valley
- Warner Valley
- Escondido Valley
- San Pasqual Valley
- Santa Maria Valley
- San Dieguito Creek
- Poway Valley
- Mission Valley
- San Diego River Valley
- El Cajon Valley
- San Diego Formation
- Batiquitos Lagoon Valley
- San Elijo Valley
- Pamo Valley
- Ranchita Town Area
- Cottonwood Valley
- Campo Valley
- Potrero Valley
- San Marcos Area

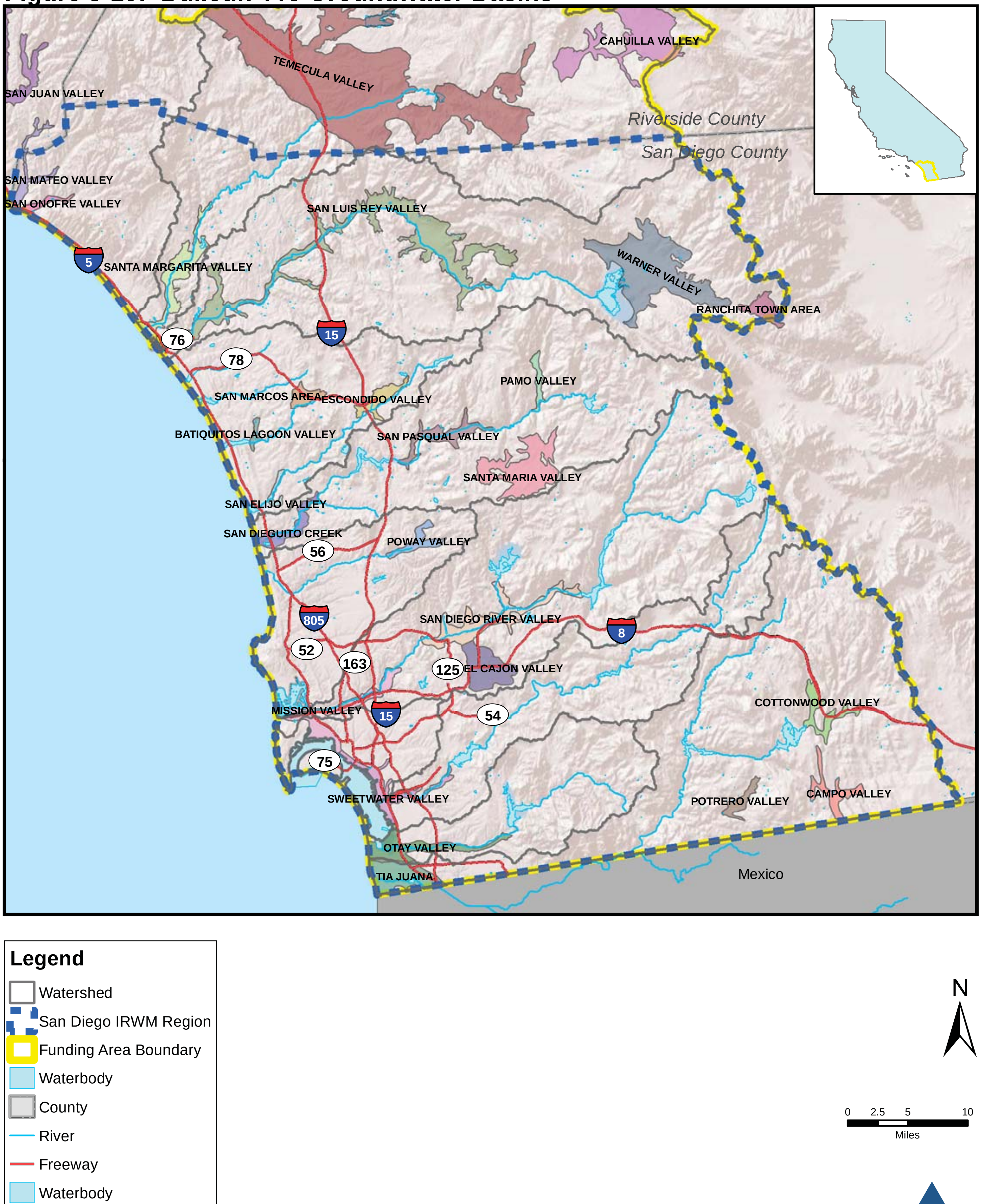
Although this IRWM Plan uses the groundwater basins defined by Bulletin 118, other local or regional plans may define basins slightly differently. For example, the *Salinity and Nutrient Management Planning Guidelines*, produced by the Water Authority and the Southern California Salinity Coalition, defines the San Luis Rey Valley groundwater basin as five basins: Oceanside/Mission, Bonsall, Moosa, Pala, and Pauma. Some basins that are recognized by a management agency may not be recognized in Bulletin 118, such as the Middle Sweetwater aquifer. The San Diego Water Board has begun to use the basins as named and defined in the *Salinity and Nutrient Management Planning Guidelines* when referring to Salt and Nutrient Management Plans in the Region.

For the most part, groundwater within the Region occurs in alluvial aquifers, residuum (crystalline bedrock that has weathered in place), aquifers comprised of semi-consolidated or consolidated sediments, and fractured crystalline rock. Other water-bearing formations in the Region include the Poway Group, San Mateo Formation, La Jolla Group, Santiago Peak Volcanics and Otay Formation. Figure 3-13 presents the locations of groundwater basins (as defined in Bulletin 118) in the Region. Groundwater yields from fractured rock and residuum can be sufficient to provide water supply for individual homes, but these aquifer types are typically not sufficiently productive to warrant supply development by water supply agencies (Water Authority, 1997). Table 3-22 summarizes characteristics of key groundwater aquifers within the Region.

Aside from the Warner, San Luis Rey Valley, and Sweetwater Valley Basins, none of the Region's alluvial aquifers exceed a storage capacity of 100,000 AF. A total of ten alluvial aquifers, however, are estimated to exceed a 50,000 AF capacity. Aquifers comprised of alluvial deposits (alluvium) provide much of the current groundwater production capacity within the region. Yields from the Region's larger aquifers are typically on the order of several thousand acre-feet per year (Water Authority, 1997; DWR, 2003).

Sources of groundwater recharge in the Region include creeks, precipitation, discharges from treatment plants, underflow from dams, and return flow. The imported water that is applied to the land as irrigation water (for agriculture and domestic irrigation) contributes to the groundwater supply in the form of return flows and may also be a resource for agencies that have usable aquifers.

Figure 3-13: Bulletin 118 Groundwater Basins



Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
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Table 3-22: Summary of the Region's Principal Groundwater Aquifers[1]

Groundwater Basin	Basin Number	Water-Bearing Formations	Surface Area (sq. miles)	Estimated Storage Capacity (AF)	Estimated Potential Yield[2,4] (AFY)	Aquifer Depth (Feet)	
						Maximum	Average
San Mateo Valley	9-2	Alluvium, San Mateo	4.7[4]	14,000[4]	3,180[3]	100[4]	60[4]
San Onofre Valley	9-3	Alluvium, San Mateo	2.0[4]	6,500[4]	1,420[3]	55[4]	25[4]
Santa Margarita Valley	9-4	Alluvium, Residuum, Fractured Rock	12.4[4]	61,600[4]	5,400 to 16,700[6]	200[4]	175[4]
San Luis Rey Valley[5]	9-7	Alluvium, La Jolla	46.0[4,5]	240,000[4,5]	22,400 to 23,400[5,6,7]	1,650[4,8]	200[4,9]
Warner Valley	9-8	Alluvium, Residuum	37.5[4]	550,000[4]	12,000[6]	900[4,10]	900[4,10]
Escondido Valley	9-9	Alluvium, Residuum, Fractured Rock	4.5[4]	24,000[4]	NA[11]	NA[11]	NA[11]
San Pasqual Valley	9-10	Alluvium, Residuum	7.1[4]	63,000[4]	5,800[6]	200[4]	120[4]
Santa Maria Valley	9-11	Alluvium, Residuum	19.2[4]	77,000[4]	>2,500[6]	225[4]	40[4]
San Dieguito Creek	9-12	Alluvium, La Jolla, Santiago Peak Volcanics	5.6[4]	52,000[4]	<2,500[6]	180[4]	125[4]
Poway Valley	9-13	Alluvium, Residuum, Poway	3.8[4]	2,330[4]	NA	75[4]	40[4]
Mission Valley	9-14	Alluvium, San Diego	11.5[4]	42,000[4]	2,000 to 4,000[6]	200[4]	80[4]
San Diego River Valley[12]	9-15	Alluvium	15.4[4,12]	97,000[4,12]	5,000 to 8,000[6,12,13]	200[4]	70[4]
El Cajon Valley	9-16	Alluvium, Fractured Rock	11.2[4]	32,500[4]	NA[11]	350[64]	NA[11]
San Diego Formation[20]	9-33	Alluvium, San Diego, Otay	31.9[4]	270,000 to 360,000[19]	10,000[19]	2,000[4,18]	300[4,18]
Batiquitos Lagoon Valley	9-22	Alluvium, La Jolla	1.2[4]	NA[11]	NA[11]	100[4]	NA[11]
San Elijo Valley	9-23	Alluvium, La Jolla, Santiago Peak Volcanics	1.4[4]	8,500[4]	NA[11]	1,650[4]	50[4]
Pamo Valley	9-24	Alluvium, Residuum	2.3[4]	NA[11]	NA[11]	NA[11]	NA[11]
Ranchita Town Area	9-25	Alluvium, Residuum	4.9[4]	NA[11]	NA[11]	130[4]	NA[11]
Cottonwood Valley	9-27	Alluvium, Residuum	6.0[4]	NA[11]	NA[11]	100[4]	NA[11]
Campo Valley	9-28	Alluvium, Residuum	5.5[4]	63,450[4]	NA[11]	100[4]	55[4]
Potrero Valley	9-29	Alluvium, Residuum	3.2[4]	NA[11]	NA[11]	NA[11]	NA[11]
San Marcos Area	9-32	Alluvium, Residuum	3.3[4]	NA[11]	NA[11]	175[4]	NA[11]

1 Groundwater Basin names and numerical designations per California Department of Water Resources *California's Groundwater* (Bulletin 118).

2 Total existing long-term yield that could be realized on an annual basis without causing long-term overdraft. Does not consider yield restrictions that may be necessary to prevent impacts to groundwater-dependent vegetation or yield

Table 3-22: Summary of the Region's Principal Groundwater Aquifers[1]

Groundwater Basin	Basin Number	Water-Bearing Formations	Surface Area (sq. miles)	Estimated Storage Capacity (AF)	Estimated Potential Yield[2,4] (AFY)	Aquifer Depth (Feet)	
						Maximum	Average

restrictions necessary to protect or improve existing groundwater quality. In many coastal basins, the available groundwater yield may not be of a quality that meets potable or irrigation use standards.

3 Value reported by U.S. Marine Corps Base Camp Pendleton within Metropolitan Water District of Southern California *Groundwater Assessment Study*, Chapter IV, Groundwater Basin Reports (Metropolitan Water District of Southern California, 2007).

4 Value or estimate presented within California Department of Water Resources *California's Groundwater* (Bulletin 118) (DWR, 2003). Total surface area of Sweetwater Valley Basin, Otay Valley Basin, and Tijuana Basin. Average aquifer depth calculated by averaging the average aquifer depth of Sweetwater Valley Basin, Otay Valley Basin, and Tijuana Basin.

5 Includes Oceanside Mission Basin, Bonsall Basin, Moosa Basin, and Pala/Pauma Basin.

6 Value reported within Metropolitan Water District of Southern California *Groundwater Assessment Study*, Chapter IV, Groundwater Basin Reports (Metropolitan Water District of Southern California, 2007).

7 Estimated yield for Mission Basin (7,000-10,000 AFY), Bonsall Basin (5,400 AFY), and Pala/Pauma Basin (8,000 AFY).

8 Maximum depth of La Jolla Formation within the San Luis Rey Valley groundwater basin.

9 Average depth of alluvium within the San Luis Rey Valley groundwater basin.

10 Depth for Temecula Arkose formation which underlies the Warner Basin.

11 Value currently unknown, as reported within DWR Bulletin 118 (DWR, 2003).

12 Includes the Mission Valley Basin and Santee-El Monte Basin.

13 Estimated yield includes 2,000-3,000 AFY from the Mission Valley Basin and 3,000-4,000 AFY from the Santee-El Monte Basin.

14 Capacity includes capacity of underlying San Diego Formation. DWR (2003) estimates the storage capacity of alluvium within the Sweetwater Valley Groundwater basin at 17,00o to 20,000 acre-feet.

15 Estimated yield includes 2,400 AF from the lower Sweetwater River Valley alluvium, 3,000 AF from the middle Sweetwater River Valley alluvium, and 3,000-5,000 AFY from the San Diego Formation.

16 Listed thickness for the San Diego Formation within the Sweetwater River Valley.

17 Yield is for the San Diego Formation within the Lower Tijuana Basin.

18 Depth of San Diego Formation extends to 1700 feet. Maximum depth of alluvium is 150 feet.

19 San Diego Formation Basin Fact Sheet. City of San Diego (2009)

20 Sweetwater Valley Basin, Otay Valley Basin, and Tijuana Basin were consolidated into one San Diego Formation Basin (Bulletin 118 Interim Update 2016).

The Water Authority (2016) reports that existing groundwater production for municipal supply purposes exceeds 23,000 AFY within the region, and includes:

- more than 6,400 AFY of production within the Santa Margarita, Las Flores, San Mateo, and San Onofre Basins within USMC Base Camp Pendleton,
- 3,300 AFY of production by the City of Oceanside from the Mission Basin (lower San Luis Rey River Valley Basin),
- Approximately 7,000 AFY of production by mutual water company wells within the Yuima Water District boundaries in the Pauma Basin (upper San Luis Rey River Valley Basin),
- more than 700 AFY of production within the Santee Basin by the Lakeside Water District,
- 93 AFY of production within the El Monte Basin by the Helix Water District,
- approximately 500 AFY of production within the Santee/El Monte Basin by the City of San Diego, and
- 5,700 AFY of production within the San Diego Formation by Sweetwater Authority.

In 1954, the Vista Irrigation District (VID) began pumping groundwater from the Warner Valley groundwater basin to supplement raw water supplies in Lake Henshaw (VID, 2016). Although VID groundwater pumping from the Warner Valley groundwater basin varies, VID estimates that since 1960 the median annual groundwater production has been 7,728 AFY (VID, 2016). This pumping is not included within the Water Authority's estimates of groundwater use.

Significant groundwater resources have been found to exist in deeper aquifers comprised of semi-consolidated or consolidated sediments. Recent field investigations indicate that one such deep aquifer, the San Diego Formation, has significant unused water storage and groundwater production potential.

While significant understanding occurs for larger alluvial aquifers that have supported ongoing groundwater development projects, additional study and evaluation is required to better understand aquifer characteristics and water supply development potential within the Region's deeper and less utilized aquifers. To address this need, the USGS, in partnership with local water agencies, has initiated a comprehensive geologic and hydrologic study of the Region's aquifers. Key objectives of the San Diego Hydrology Project include:

1. Develop an integrated, comprehensive understanding of the geology and hydrology of the San Diego area, focusing on the San Diego Formation and the overlying alluvial deposits.
2. Use this understanding to evaluate expanded use of the alluvial deposits and the San Diego Formation for recharge and extraction.

To develop data in support of these objectives, the USGS study has completed 12 multiple-depth test wells in and around the San Diego Formation, along with an additional well in the Santa Ysabel area. Four additional deep test wells are planned as part of this effort.

Groundwater Demineralization

Public water agencies currently utilize groundwater resources to develop municipal water supply within the following watersheds: San Juan (901), Santa Margarita River (902), San Luis Rey River (903), San Dieguito River (905), San Diego (907), and Sweetwater (909). Demineralization treatment of groundwater is utilized in three of these groundwater basins and has increasing appeal to local agencies. In 2017, Sweetwater Authority, in partnership with the City of San Diego, completed construction of an expansion to the Richard A. Reynolds Desalination Facility that doubled its production capacity. Other agencies, particularly in northern San Diego County, are also considering constructing or expanding their groundwater desalination facilities in the future. Olivenhain Municipal Water District is currently studying the feasibility of developing its own demineralization treatment facility. Table 3-23 summarizes groundwater demineralization treatment facilities within the Region.

Reynolds Desalination Facility

Photo Credit: Sally Johnson, Woodard & Curran

Table 3-23: Groundwater Demineralization Facilities

HU[1]	Watershed	Groundwater Demineralization Facility	Operating Agency	Treatment Capacity[2] (mgd)	Source of Groundwater
902	Santa Margarita River	Haybarn Canyon	USMC Camp Pendleton	6.9	Santa Margarita Basin
903	San Luis Rey River	Mission Basin	City of Oceanside	6.37	Mission Basin
909	Sweetwater River	Reynolds	Sweetwater Authority	10.0[3]	Lower Sweetwater Basin

1 Numerical watershed (hydrologic unit) designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
2 Potable water production capacity. Influent treatment plant capacity is larger as part of the flow is lost as waste brine. mgd = million gallons per day
3 From *2015 Urban Water Management Plan* (Sweetwater Authority, 2016).

3.5.7 Conservation

Water conservation is a fundamental component of the Region's water supply diversification effort. The Water Authority and its member agencies have been aggressively implementing water conservation since 1990. Under SB 606 and AB 1668, the Long-Term Water Conservation Regulations, mandatory indoor and outdoor water budgets will be established statewide, with regular reporting to the state for accountability. Conservation efforts in the region will help local agencies meet these requirements. The State's Model Water Efficient Landscape Ordinance (MWELO) was updated in 2015 in response to the recent drought, and further increased water efficiency standards. As a result, local and regional ordinances were also updated to require increased irrigation efficiency and reduce irrigation demands.

There are two types of water conservation in the Region, both of which contribute to Regional water supplies: 1) water conserved through reduced loss from both the Water Authority and other agencies' systems, and 2) water conserved through reduced user demand. Water conservation through loss reduction has been achieved through projects that line canals that bring imported water to the Region and other infrastructure improvements. Potable water demand reduction can take place in a traditional water conservation setting whereby water users use less water on a per capita basis. In addition to traditional water conservation, implementation of onsite systems that use alternative water sources such as graywater systems, rainwater harvesting systems or on-site industrial reuse can reduce potable water demands.

The Sustainable Landscapes Program was funded under Proposition 84 Round 1
Photo credit: Kyrsten Burr-Rosenthal, Water Authority

Water Use Reduction Programs

Significant Water Authority and member agency funding has been directed toward implementing comprehensive water conservation best management practices (BMPs) (see inset below) to reduce water use for residential, commercial, and agricultural irrigation, and to reduce water use in homes, businesses, industries, and institutions. Annual water audits are submitted by water agencies to understand and report where water loss is occurring in their systems, which helps to identify opportunities for reducing water loss.

The comprehensive water conservation program implemented by the Water Authority and its member agencies was accelerated during the 2012-2016 drought and is anticipated to continue to grow conservation benefits into the future. The Water Authority's 2015 UWMP estimates that conservation will grow from approximately 74,000 AFY in 2020 to over 128,000 AFY by 2040 (Water Authority, 2016). Conservation estimates were developed using the Alliance for Water Efficiency Water Conservation Tracking Tool, which accounts for existing and future passive and active water savings. Within the San Diego IRWM region, passive conservation is anticipated to increase as appliance standards and code changes increase water use efficiency and as existing landscape converts to water wise landscaping. Active conservation is anticipated to increase as the 2015 Model Water Efficient Landscape Ordinance (MWELO) continues to be implemented in new development and as Water Authority member agencies continue to move towards compliance with SBx7-7 water use targets. Regional water-use efficiency programs include the Regional WaterSmart Turf Replacement Program, the SoCal Water$mart Commercial, Industrial, and Institutional Program, Water Savings Incentive Program, the On-site Recycled Water Conversions Program, and the Sustainable Landscapes Program. Additionally, the Water Authority and its member agencies are undertaking measures to comply with Senate Bill 7-7 (SBx7-7), which require retail urban water agencies to achieve a 20% reduction in per capita water use by 2020. In the 2015 UWMPs, all of the Water Authority member agencies reported that they were on target to meet their SBx7-7 use reduction goals.

California Urban Water Conservation Council
Water Conservation Best Management Practices (BMPs)

The Water Authority and its member agencies comply with all 13 water conservation BMPs developed by the California Urban Water Conservation Council, including:

Operation Practices

- Conservation coordinator
- Water waste prevention
- Wholesale agency assistance programs

Public Outreach

- Public information programs
- School education programs

Residential

- Residential assistance program
- Landscape water survey
- High-efficiency clothes washers
- WaterSense Specification toilets
- WaterSense Specifications for residential development

Commercial, Industrial, and Institutional

- Commercial, industrial, and institutional savings

Landscape

- Savings for dedicated landscape irrigation accounts
- Savings from CII accounts within meters or mixed use meters

Source: CUWCC Resource Center: http://www.cuwcc.org/bmps.aspx

While many regional efforts have been implemented to increase conservation, especially with regards to outdoor water use for landscape irrigation, regional stakeholders have indicated that there are impediments to conservation. The public's attitude about what are acceptable landscaping options given the Region's warm and dry Mediterranean climate, need to change to match the current climate. There are a wide range of options available for landscapes which use a minimal amount of water and still look beautiful. Contrary to State law, homeowners associations are still trying to enforce outdated rules that restrict the use of certain plants, and therefore provide an impediment to landscaping with low water use plants. Public education and a conservation ethic is critical to achieving outdoor conservation.

Graywater

Graywater is defined as wastewater that is generated from domestic activities such as laundry and bathing. To protect human and environmental health, graywater systems reuse untreated wastewater that has not been contaminated by food or human waste for non-potable purposes, primarily irrigation.

Conservation Home Makeover in the Chollas Creek Watershed
Groundwork San Diego

Photo credit: Leslie Reynolds, Groundwork San Diego

Groundwork San Diego has partnered with the U.S. Green Building Council, San Diego Sustainable Living Institute, San Diego Unified School District, and Encanto Community Planning Group to implement the "Conservation Home Makeover". The project engages low income families within the Encanto neighborhood of San Diego to conserve water through water capture and greywater reuse for food production and landscaping. This project addresses DAC needs for water conservation, water supply, and food security and supports the Region's goals of water supply sustainability, protection of natural resources, and promotion of sustainable resource management.

Although the potential for graywater reuse to reduce potable water demand has long been recognized, potential public health issues related to the use of graywater required additional time to develop permitting processes and regulations. As the use of graywater becomes more attractive to consumers, permitting and regulations are becoming more streamlined, helping to reduce barriers to widespread implementation of graywater systems in the Region. In 2009 DWR released an emergency order that eased the permitting process for graywater systems in California. Per State Plumbing Code Chapter 16A, graywater systems supplied by washing machines generally do not require a permit, though more complex systems or ones that utilize other graywater supply sources typically do. General requirements for graywater systems include the ability to direct graywater to both irrigation and sewer systems, a physical barrier or air gap to prevent backflow and cross-contamination, subsurface irrigation systems, and design that prevents ponding or runoff. Additionally, graywater cannot make direct contact with edible portions of food crops. Cities, counties, and other jurisdictions may place additional regulations on graywater systems and uses (HCD, 2010). Within the Region, local cities and the County of San Diego (Department of Environmental Health) regulate graywater through adoption of the plumbing code.

Challenges to widespread implementation of graywater systems include the expense of installation and restrictions on use, both of which place limits on graywater system installation (City of San Diego, 2002). The City of San Diego has estimated that graywater could potentially provide 2,575 AFY of irrigation water by 2035 (City of San Diego, 2013b). If this amount of graywater were to be used in the City, it would represent just over 1% of the City's 2035 water demands (City of San Diego, 2016).

Rainwater Capture

> ***City of San Diego's Rain Barrel Rebate Pilot Program***
>
> The City of San Diego initiated its Rain Barrel Rebate Pilot Program in 2012 which offers single-family residential customers the opportunity to receive a rebate when connecting a newly installed rain barrel to a rain gutter downspout in that collects precipitation from the rooftop. This rebate is available periodically as funds allow and is next expected to reopen in July 2018. The amount of rain water that can be collected depends on several variables, including dimensions of the rooftop, storage capacity of the rain barrel(s), as well as the amount and timing of rainfall. A general rule of thumb follows that 1,000 square feet of rooftop surface captures 625 gallons of water when an inch of rainwater falls. Since the start of the City's program, over 300 rain barrel rebates have been issued with water savings projected at 1,113,250 gallons (3.4 AF) per year.

Rainwater capture is another tool for water conservation in the Region. As its name implies, rainwater capture involves diverting, capturing, and storing rainwater runoff before it enters the storm sewer system. Captured rainwater can be used for non-potable purposes, such as irrigation, or may be allowed to recharge into groundwater basins. Capturing and reusing rainwater can reduce water demands for irrigation or groundwater recharge, benefit water quality through reduced stormwater runoff, reduce the load on regional stormwater infrastructure, and help mitigate high runoff flows from impervious surfaces that cause hydromodification of streams and rivers. While rainwater capture can minimize peak flows and retain pollution onsite, it can reduce flows to local watersheds. Rainwater capture through groundwater recharge is limited in the San Diego region due to the small size of the local groundwater basin and the presence of expansive clay soils.

Common methods of rainwater capture include installation of rain barrels to collect water from rooftops, cisterns to capture water from roofs and parking lots, and rain gardens designed to collect rainwater and allow the water to irrigate onsite plants. Though the Region encourages the use of rain barrels, cisterns, and rain gardens, it is important to properly design rainwater capture systems for the appropriate volume of water expected to be captured and to accommodate individual site characteristics, such as soil type or slope. The City of San Diego has produced a *Rainwater Harvesting Guide* (City of San Diego, 2012) that details how to design a rainwater harvesting system. This guide encourages customers to select plants for a proposed rain garden that have a corresponding water need to the expected volume of rainwater that can be captured by the system. For example, if the site only receives a few inches of rain per year, a rain garden of tropical plants would require additional irrigation, as its water needs would not be met by the captured rainfall. Instead, landowners in areas with low rainfall should select less-water intensive plants, such as native plants or succulents.

The 2018 Stormwater Capture and Use Feasibility Study (SWCFS) includes the potential for public/private partnerships that could implement large-scale rainwater capture systems on large private developments and then convey this water to treatment systems for beneficial reuse. While this type of project is not currently implemented in the Region, it could become more common if additional regulatory clarity were provided, as well as additional flexibility in the stormwater alternative compliance program (County of San Diego, 2019).

Low Impact Development

In addition to rainwater capture that involves capturing water and storing the water for irrigation purposes, landscapes can be modified to increase local infiltration potential, which will help to ensure that water that falls on the ground is infiltrated rather than running off the surface as stormwater.

Increasing infiltration through Low Impact Development (LID) is a long-term rainwater capture strategy that helps to restore soil moisture and improve ecosystem health by restoring sub-surface water flows. LID projects were found to be feasible with high number of potential sites in the SWCFS, but the ability to infiltrate water captured through LID is limited by soil types at sites.

There is a diversity of LID designs and functions, with varying degrees of natural and engineered components. LID systems are effective because they mimic natural systems and can reduce infrastructure and maintenance costs over time. LID can include bioretention facilities or rain gardens, grass swales and channels, vegetated rooftops, rain barrels, cisterns, vegetated filter strips, and permeable pavements. Some LIDs are designed to filter out contaminants before directing flows to storm drains. The 2013 MS4 permit mandates that no additional runoff may occur from new developments in the MS4 permit area. This requirement will encourage implementation of rainwater capture-friendly LID measures (County of San Diego, 2007).

Regional Stormwater Green Streets

The Region is implementing a series of green street projects to implement stormwater management and LID. These include the Mapleview Street Project, Woodside Avenue Project, Sweetwater River Park Bioretention Project, LID Urban Runoff Control Projects for the Tijuana Estuary, and the South Santa Fe Green Street Project.

The County's Mapleview Street Project will treat runoff from 64 acres of primarily residential development, and will include biofiltatration basins, permeable pavements and vegetated swales, while also installing sidewalks and bike lanes to encourage alternative transportation. The County's Woodside Avenue Project is similar in nature, and will treat wet weather flows from a 93-acre area. Together, the County's projects are expected to retain between 120,000 and 160,000 cubic feet of stormwater per year (2.75 – 3.7 AFY), remove 93,000 lbs of GHGs per year, provide trash from entering waterways, help address flooding, and remove metals and nutrients from stormwater.

Reducing stormwater runoff improves water quality by increasing natural filtration of pollutants from runoff flowing slowly through vegetation and percolation through permeable surfaces, reducing the amount of pollutants washing into local waterways over time, and reducing habitat changes that may have a negative impact on water quality. Pollutants found on exterior surfaces are conveyed through runoff into waterways. Although reduced runoff can contribute to improved water quality, these pollutants are still present, and will enter waters during the "first flush" event – the first major storm event following the dry season. However, the first flush event tends to move pollutants to the ocean more quickly and at greater dilution than when carried by smaller rainfall events that would produce runoff without rainfall capture efforts in place.

3.5.8 Stormwater Management

Stormwater is managed under the Region's MS4 Permit, as described here and in *Section 3.6.4*. Stormwater in the Region is diverted to each agency's municipal separate storm sewer system (MS4). An MS4 is legally defined as a system through which stormwater and non-stormwater are discharged to waters of the United States (San Diego Water Board, 2013a). In the San Diego Region, MS4 systems fall into one or more of the following categories:

1. A medium or large MS4 that services a population of greater than 100,000 or 250,000 respectively

Water Terminology

Urban Runoff: used here to describe water that travels through and across urbanized areas; includes natural precipitation that falls in urban areas as well as water released into the urban environment as a result of other uses (e.g., over-irrigation of lawns, washing cars in driveways, leaking pipes, etc.). Typically of concern due to the potential to transport pollutants.

Stormwater: any water that falls during a precipitation event as well as any water that enters an MS4 in the Region.

Non-Stormwater: water released into the environment from non-precipitation events, such as improper irrigation practices, regardless of whether it occurs in urbanized areas.

This terminology varies somewhat from regulatory definitions used.

2. A small MS4 that is "interrelated" to a medium or large MS4
3. An MS4 which contributes to a violation of a water quality standard
4. An MS4 which is a significant contributor of pollutants to waters of the United States

An MS4 comprises the ditches, storm pipes, retention ponds and other facilities constructed to store runoff or carry it to receiving waters such as streams, lakes, bays, or the ocean. Other constructed features in such a system include LID features that collect runoff and direct it to storm drains and ditches. Most MS4s are designed to handle specified storm flows, such as the amount of water expected during a 10-year storm. Larger storms may cause overload and result in backed-up storm drains and ditches and produce shallow flooding (FEMA, 2007).

An MS4 is designed to prevent or reduce flooding in developed areas. Because MS4s usually do not provide treatment prior to discharging collected stormwater, they can present a water quality challenge, as stormwater can have high levels of pollutants collected during runoff. The MS4s in the Region also collect urban runoff which can carry pesticides, fertilizers, and anything that is dumped into storm drains, such as oil or trash, to the receiving waters. As the Region continues to grow, addressing pollution from stormwater and the MS4 is imperative. In general, stormwater programs governed by the MS4 permit include:

- Urban runoff and receiving water monitoring during wet and dry weather,
- Assessment of water quality trends, potential sources, and impacts,
- Standards to manage runoff discharge rates and durations from all new development, and
- Programs to prevent, control, and treat sources of pollutants such as BMPs, water conservation, public education and outreach, maintenance of streets and storm water infrastructure, inspections of pollutant generating activities.

Stormwater is managed by the jurisdictions that own and operate the MS4 system and is regulated by an MS4 Permit granted by the San Diego Water Board.

Since 2001, the MS4 Permit for the San Diego Copermittees has shifted to include a variety of new stormwater management plans and requirements for stormwater mitigation and oversight. Additionally, the current MS4 Permit (Order No. R9-2015-0001 and Order No. R9-2015-0100) includes the portions of south Orange County and south Riverside County that are within the San Diego Water Board area (and align with the South Orange County and Upper Santa Margarita Watershed IRWM Regions, respectively). New to this 2015 permit was the development of WQIPs for each watershed management area. WQIPs define priority water quality conditions, establish water quality improvement goals and strategies, and incorporate integrated monitoring and assessment plans to help guide runoff management programs in improving water quality in MS4 discharges and receiving waters (San Diego Water Board, 2013a). The permit also includes more rigorous development and redevelopment requirements that include an offsite mitigation option for development projects where onsite retention and treatment are not technically feasible, or where applicants can demonstrate a greater overall benefit to water quality by mitigating offsite. The

Water Quality Improvement Plans (WQIPs) for the San Diego IRWM Region

A key feature of the 2013 MS4 Permit is that it provides an "adaptive management pathway" for Copermittees to select and address the highest priority water quality issues, rather than all pollutants. The WQIPs, which are developed via a collaborative process between the Copermittees, watershed stakeholders, and Regional Board staff, specify the highest priority pollutants in each watershed and lay out a strategy and schedule for addressing those pollutants.

The WQIPs are available on the Regional Board's website:

https://www.waterboards.ca.gov/sandiego/water_issues/programs/stormwater/wqip.html permit also includes adopted TMDL waste load allocations as numeric water quality-based effluent limits that must be achieved by specified timelines. Finally, the permit requires Copermittees to implement expanded programs to pro-actively address urban runoff discharges from residential areas, including a stronger emphasis on eliminating or reducing over-irrigation flows.

Improved stormwater quality is a central component to multiple IRWM Plan objectives. Specifically, activities that contribute to Objective G and Objective H frequently manifest themselves as stormwater or stormwater quality control. The IRWM Program includes numerous projects that reduce impervious surfaces, increase infiltration, and reduce runoff. Changes in landscaping practices, such as using water-wise plants instead of turf or improving irrigation practices, also help to reduce the pollutants in stormwater and runoff. Restoration projects also frequently increase the ability of an area to act as natural filters for runoff, providing benefits to water quality and hydromodification issues downstream. Carbon sequestration represents another ecosystem service that may be provided through restoration. By helping to meet the Plan objectives, these types of projects are more likely to be prioritized or selected for inclusion in IRWM funding packages and help to improve stormwater management region-wide. Projects designed to improve the scientific basis of water quality regulations are consistent with the IRWM regulatory strategies outlined in *Chapter 7, Regional Coordination*.

Challenges to managing stormwater in the Region frequently stem from the expense of BMP installation, variability and uncertainty of BMP success, jurisdictional boundaries that are not aligned with watersheds or drainage areas, differences in land use and priorities, debate over appropriate water quality standards that are protective of beneficial uses, uncertainty over the ability to comply with the terms of the Region's MS4 Permit, and the high variability in annual rainfall experienced by the Region. There has also been some debate over the water quality standards established by the San Diego Water Board, and the future may see a shift from some of the current concentration-based standards to biological criteria, such as those considered in the nutrient numeric endpoint (NNE) based standards. This shift may affect which management strategies are

Determining Appropriate Water Quality Objectives: Santa Margarita River

Nitrogen and phosphorous loading from the Santa Margarita River Watershed can result in low dissolved oxygen (DO) and increased algal blooms in the estuary and stream segments, several of which have been 303(d)-listed for nitrogen, phosphorus, or eutrophication. Total Maximum Daily Loads (TMDLs) are not currently in place in most of the Santa Margarita River Watershed segments which are listed for nutrient impairment. At this time, there is little scientific knowledge about the appropriate level of nutrients that the Santa Margarita River can sustainably assimilate.

The Santa Margarita River Nutrient Study – funded through Proposition 84, Round 1 – aims to establish the science and seek stakeholder consensus to develop seasonal nutrient water quality objectives (WQOs) that are protective of beneficial uses. Stakeholders believe that since the estuary through which the Santa Margarita River flows is open to the ocean during the winter (the wet season), nutrients in the river only have a short residence time before they enter the ocean. Development and adoption of seasonal WQOs would significantly decrease stormwater treatment costs during a timeframe in which there are no real impacts to riverine species or habitats. The project conducted 33 sampling events over seven sites from January to September 2015 and then again from April to July 2016. Water quality data collected included nutrient loads, dissolved oxygen (DO), pH, temperature, and conductivity. The next phase of work – funded under Proposition 84, Round 2 – will use data collected during this project to develop the nutrient water quality goals.

Nutrient water quality data collection will help the Region better understand how to manage the Santa Margarita River.

Photo credit: JoAnn Weber, County of San Diego necessary or appropriate, and may make management easier or more challenging, depending on if or how changes to standards are implemented.

Another challenge to stormwater maintenance involves balancing multiple and sometimes conflicting interests. For example, the City of San Diego's Municipal Waterways Maintenance Plan identifies channels within the City's jurisdiction that have deposits of sediment and overgrowth of vegetation that require maintenance to restore stormwater and flood control capacity. This program was challenged by local organizations for its potential habitat fragmentation and biological impacts, and a Settlement Agreement was reached that incorporated additional water quality measures and biological mitigation requirements into the program. This program, and others across the Region, must balance flood control safety and stormwater maintenance requirements with natural resources protection.

As the State continues to grapple with drought conditions, a greater emphasis has been placed on using stormwater as a resource. The Region is studying how to leverage stormwater as a supply source but must also consider the significant water quality issues associated with stormwater reuse. The 2018 SWCFS (County, 2018), which expanded on the findings of the 2017 Stormwater Water Resource Plan (County, 2017), created a methodology for identifying the potential for stormwater capture at a given site, to assist with improving the Region's ability to utilize stormwater as a resource. This study is designed to be used as a tool to assess the feasibility of implementing stormwater use alternatives in planned projects.

3.5.9 Flood 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 (San Diego County, 2010).

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, 2005, and 2017. 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

(San Diego County, 2011a). 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.

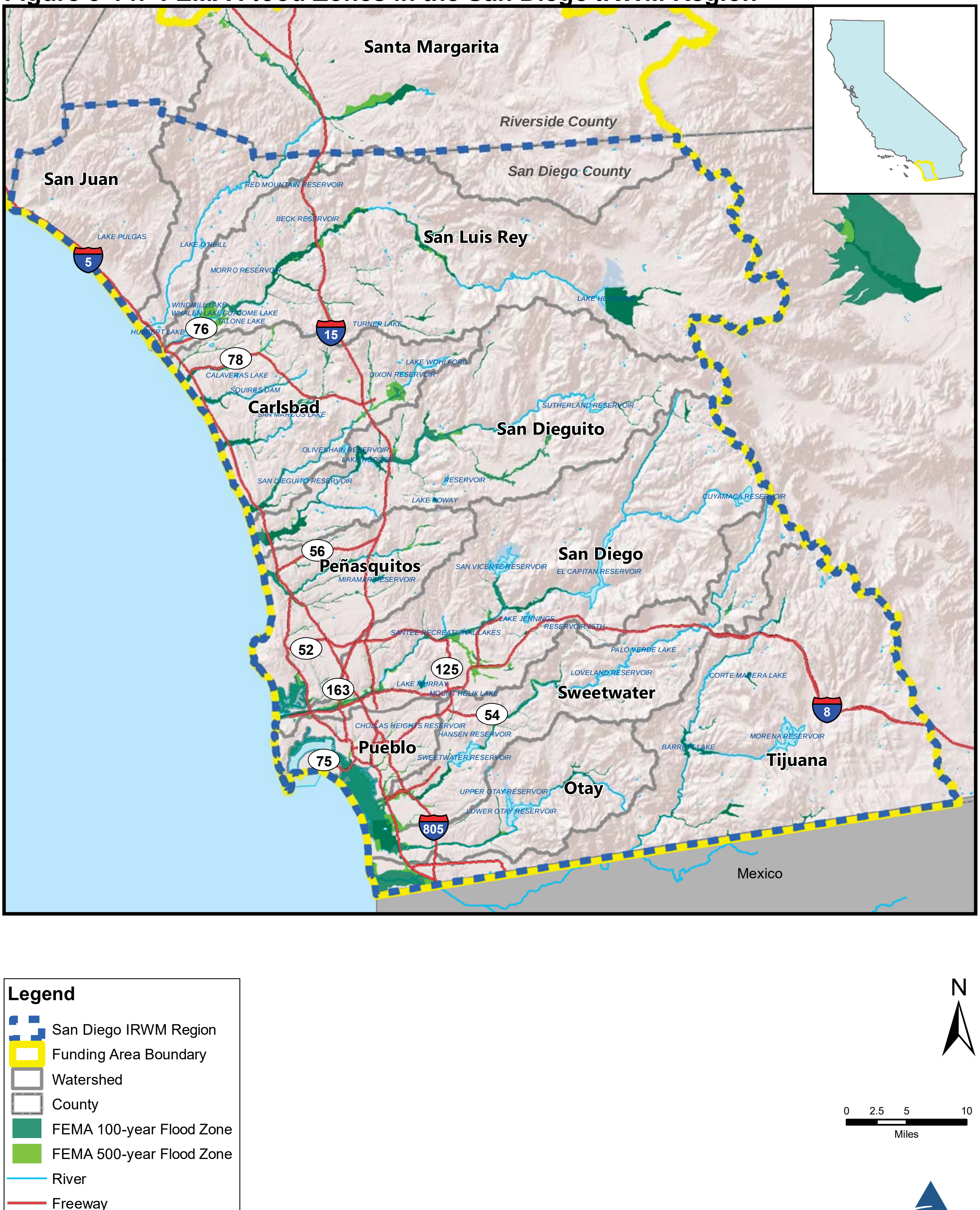
Non-precipitation-induced flooding is caused by urbanization, landform modification, faulty drainage facilities, dam failures, tsunamis, seiches (standing waves in an enclosed or partially enclosed body of water), and high surf during storm events. Of these, the Region is most at risk from flooding caused 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). Sea level rise is anticipated to increase the risk of non-precipitation-induced flooding.

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. The Region’s FEMA flood zones are shown in Figure 3-14.

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). Locally identified “hot spot” flood areas are listed in Table 3-24 below.

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 Water Authority, 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, continuing to monitor and assess drainage, and developing comprehensive flood management and response plans (San Diego County, 2010).

Figure 3-14: FEMA Flood Zones in the San Diego IRWM Region



Source: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\AdminDraftMaps\060713_JD\Fig3-1_Overview of Regions Watersheds_060713.mxd

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Table 3-24: Local "Hot Spot" Flood Areas[1]

HU	Watershed	Flooding Source	Location and/or Description
902	Santa Margarita River	Santa Margarita River	Sandia Creek Drive and Rock Mountain Drive affecting Fallbrook and De Luz
903	San Luis Rey	Upper San Luis Rey River	Between Lake Henshaw and La Jolla Indian Reservation; Cole Grade Road; and Shearer Crossing (San Luis Rey River at I-15); Pauma Valley Drive: Wiskon Way; Valley Center Road (Rincon Casino)
904	Carlsbad	Escondido Creek	El Camino Del Norte near Rancho Santa Fe and Olivenhain
		Escondido Creek	At Country Club Road; Elfin Forest
		Twin Oaks Creek	At Sycamore Road/Walnut Grove
		San Marcos Creek	From Discovery Street to East of SR-78
905	San Dieguito River	San Dieguito River	Downstream from Hodges Reservoir to Del Mar
		Hatfield Creek	Magnolia Avenue in Ramona
		Santa Maria Creek	In Ramona; Rangeland Road
907	San Diego River	San Diego River	Mission Valley and Fashion Valley Mall; Fashion Valley Road; Avenida del Rio; Camino del Este
		San Vicente Creek	Below San Vicente Reservoir, Moreno Valley
		Lemon Crest (Lakeside)	Local flooding problem
		Dulene Drive (Lakeside)	Local flooding problem
		Adlai Drive (East Lakeview)	Local flooding problem
909	Sweetwater River	Spring Valley Creek	Quarry Road at Spring Valley Creek
		Sweetwater River	Singing Hills Country Club
		Wildoats Lane off Central Avenue	Yearly flooding problem identified by Flood Control staff
911	Tijuana River	Tijuana River Valley	Tijuana River Regional Park; Hollister Street; Dairy Mart Road
		Cottonwood Creek	Trailer Park at Barrett Junction
		Campo Creek	Campo Valley flash flooding

1 From *Floodplain Management Plan* (FEMA, 2007).

Flood Warning Program

The San Diego County Flood Control District (FCD) has the responsibility to provide flood warning services for the County of San Diego. This program encompasses three components: the ALERT Flood Warning System, the Webcam Program, and the Flood Forecast System.

ALERT Flood Warning System

The ALERT Flood Warning System was developed in 1982 to address the need to obtain real-time rain and stream level data in order to detect flood-producing events early enough to respond in a timely manner. The system started out with 14 stations and has since expanded to over 120 stations. Data collected by the individual field stations are relayed in real-time to nearby data repeaters, which in turn, relay the data to the flood warning base station in Kearny Mesa. Incoming data is received by the flood warning computer, examined for quality control, examined for meeting any alarm criteria, then is placed into the database. Displays are updated, and if the data meet alarm criteria, a warning is issued on the computer, and a text message is assembled and sent to designated emergency personnel via email or smart phone. Emergency staff responds to the alarm and contact the pertinent emergency agencies with information and recommendations. The ALERT flood warning system forms the core of the County Flood Warning Program and is used to provide input to flood forecast programs and provide real-time warning to emergency managers.

FCD Webcam Program

The County of San Diego has several low water crossings over creeks and rivers. These crossings are either built directly on the river bottom or have small culverts to carry low flows under the road. Several times per year, heavy rainfall in the region is sufficient to cause enough runoff to flood several low water crossings in the County. The County has recently begun a program of placing internet webcams at key low water crossings with a history of flooding and flooding-related accidents. By accessing an in-house County website, these webcams can be controlled by emergency managers to check the magnitude of flooding at a crossing, check the quality of the road conditions during and immediately after flooding, identify vehicles that may have gotten trapped in the flood waters, and enable the public to examine the condition of the road during storms to determine whether they should use the crossing. Current webcams are located at Country Club Drive at Escondido Creek, Quarry Road at Spring Valley Creek, and Sandia Creek Road at Santa Margarita River. There is one candidate for a future webcam at Cole Grade Road on the San Luis Rey River. The public can view, but not control, the webcams at http://sdcfcd.org/.

San Diego County Flood Forecast Program

Occasionally, the magnitude of the periodic flooding in San Diego County river systems is high enough to cause significant damage and injury. Recently, the FCD contracted with DHI Water and Environment to develop a comprehensive flood forecast model to cover the entire San Luis Rey Watershed and its primary tributaries. At regular timed intervals, the model retrieves rainfall and streamflow data from the ALERT Flood Warning system, and forecast rainfall from the National Weather Service website (http://www.weather.gov/). This information is run through the model to create a forecast of the expected flow conditions at several points along the San Luis Rey River and its primary tributaries. Analysis results are uploaded to a public website and a private emergency managers' website. The websites display the ALERT flood warning data from the stations within and near the watershed, point forecasts at nearly 100 bridges and low water crossings in the watershed, floodplain forecasts at five sensitive floodplains within the watershed, and a "state of the watershed" map showing the current water conditions at the forecast points. Emergency managers have access to detailed point forecasts, and animated floodplain maps that enable the user to drill right down to the street level to determined expected areas of flooding.

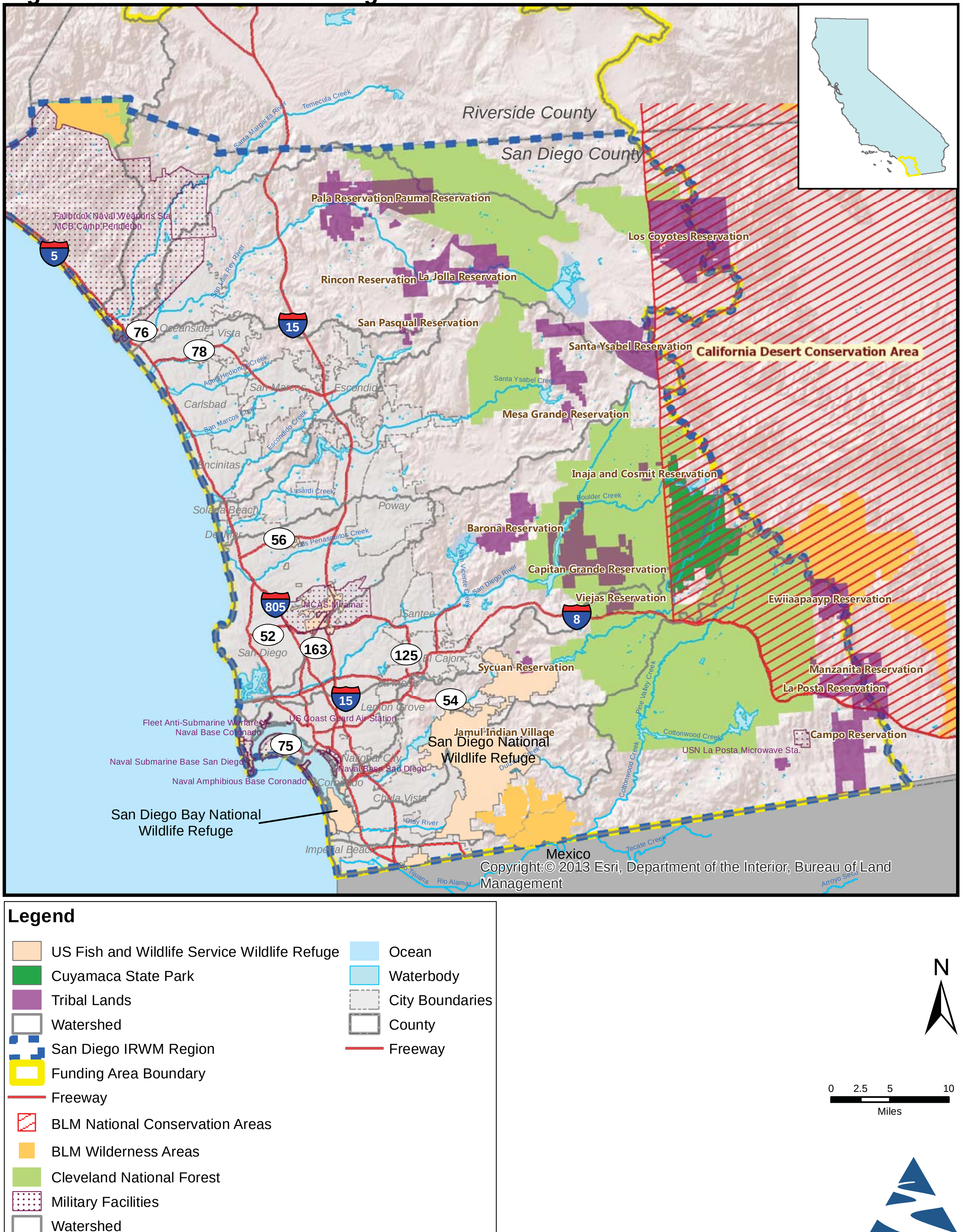
As funds allow, the model will be extended over time to cover the major watersheds of the San Diego River, Sweetwater River, San Dieguito River, and possibly the Tijuana River.

3.6 Internal Boundaries

3.6.1 Land Use Jurisdictions

Figure 3-15 identifies agencies responsible for land use and land planning within the region. The County, the 18 incorporated cities, and their associated planning districts support community planning, maintain comprehensive plans as required by statute, and administer and enforce land use codes and ordinances.

Figure 3-15: Land Use Planning



Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse, Department of Interior and Bureau of Land Management.
N:\Projects GIS\0188-003 SDIRWM Plan Update\AdminDraftMaps\060713_JD\Fig3-13_Land Use Planning 060813.mxd

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The USMC Base Camp Pendleton covers over 125,000 acres in the north portion of the Region. More than a dozen other military facilities exist within the Region. Additional federal land managers within the Region, in part, include the USFS, BLM, National Oceanic and Atmospheric Administration (NOAA), and the United States Fish and Wildlife Service (USFWS). USFS manages the Cleveland National Forest, which comprises the eastern portions of several of the Region's larger watersheds. BLM manages lands designated as Wilderness Areas, BLM National Monuments, BLM Public Lands, and BLM Wilderness Study Areas. USFWS manages the National Wildlife Refuge in the southwestern part of the County. NOAA co-manages the Tijuana River National Estuarine Research Reserve (TRNERR), located along the coast near the border, with California State Parks and USFWS.

State land managers include the California Department of Fish and Wildlife (CDFW), which manages land to implement CDFW's Natural Community Conservation Plan (California Fish and Game Code Sections 2088-2805), and the California State Parks, which manages parklands such as Cuyamaca State Park. CDFW's Natural Community Conservation Plan seeks to conserve natural communities at the ecosystem scale while accommodating compatible land use.

Tribal lands are significant in the Region: there are more Tribal Reservations within the County than in any other county in the United States (University of San Diego, 2006). These Reservation lands, which are governed by Tribal Nations, total 127,000 acres (approximately 200 square miles). The Region's tribal lands are described in detail in *Chapter 4, Tribal Nations of San Diego County*.

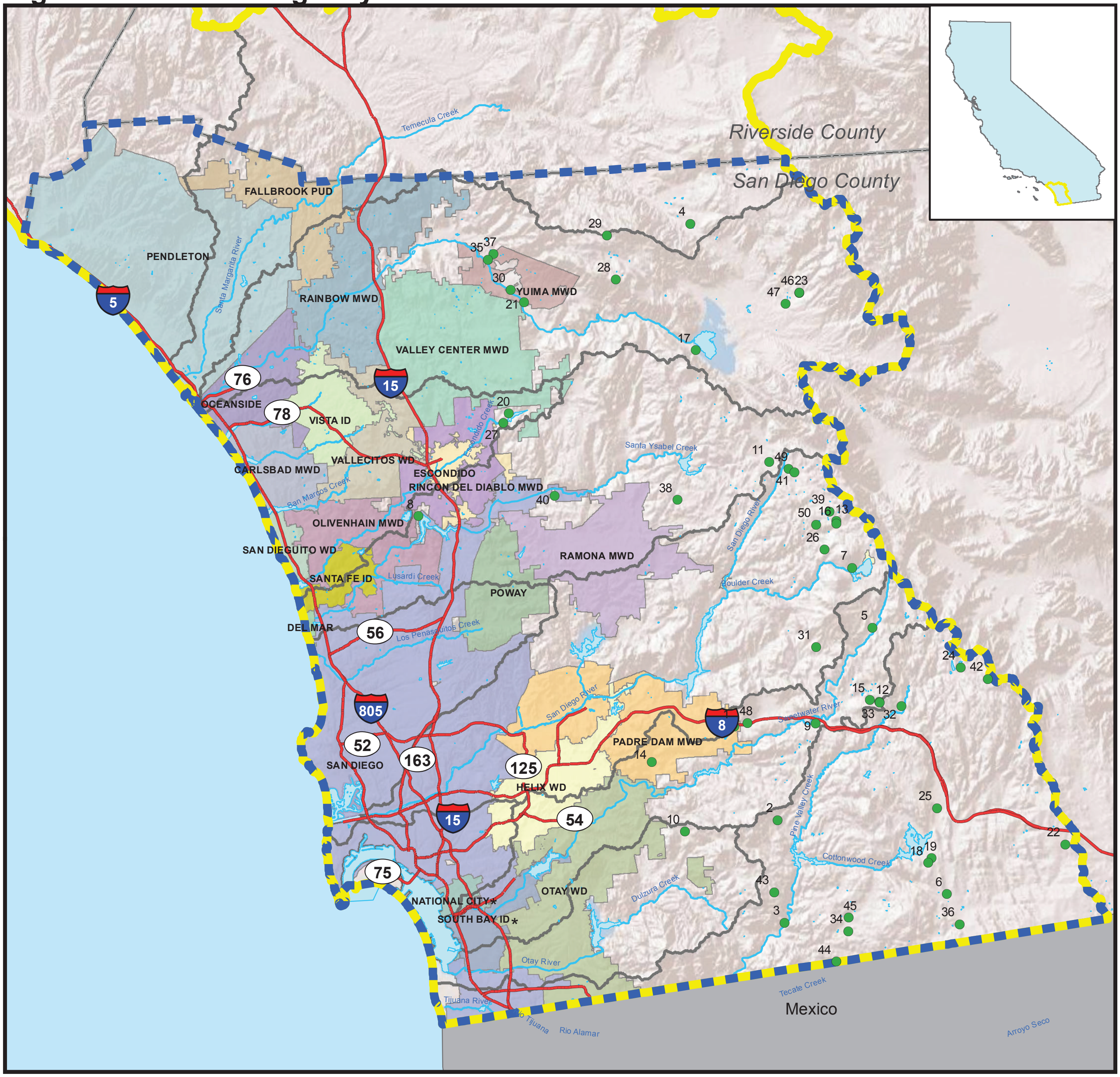
3.6.2 Water Supply Agencies

Water supply within the Region is predominantly imported water provided by the Water Authority, which is the sole imported water wholesale agency within the region. All major retail water agencies within the Region are members of the Water Authority. Figure 3-16 presents boundaries of Water Authority member agencies. *Section 3.5* provides a general description of the Region's water management systems, including supply sources.

In addition to serving as the Region's provider of imported water, the Water Authority serves as a regional water planning agency to coordinate regional water issues. In this role, the Water Authority assists its member agencies (through financial, coordination, or planning support) in implementing local water planning and project development, and provides a forum for member agencies to discuss and address regional water issues. Most Water Authority member agencies maintain interagency agreements with adjoining member agencies to maximize conveyance flexibility and emergency response.

The rural eastern portion of the Region is outside the Water Authority's service area. Water service within this eastern area is provided by either onsite private wells or by small community water systems or private water companies.

Figure 3-16: Water Agency Boundaries



Legend

- Small Water Systems
- San Diego IRWM Region
- Prop 84 Funding Area Boundary
- Mexico
- Waterbody
- Freeway
- River

Map ID	Small Water System	Map ID	Small Water System
1	ALPINE OAKS ESTATES	26	NORTH PEAK MUTUAL WATER CO.
2	BARRETT HONOR CAMP	27	OAKVALE PARK
3	BARRETT LAKE MOBILEHOME PARK	28	PALOMAR MOUNTAIN MW CO.
4	BUTTERFIELD OAKS MH PARK	29	PALOMAR OBSERVATORY
5	CAMP CUYAMACA	30	PAUMA VALLEY MUTUAL WATER CO.
6	CAMPO ELEMENTARY SCHOOL	31	PHOENIX HOUSE
7	CUYAMACA WATER DISTRICT	32	PINE VALLEY BIBLE CONF. CENTER
8	DEL DIOS MUTUAL WATER CO.	33	PINE VALLEY TRAILER PARK
9	DESCANSO DETENTION FACILITY	34	POTRERO ELEMENTARY SCHOOL
10	DIAMOND JACK'S RV RANCH	35	RANCHO CORRIDO RV RESORT
11	DUDLEY'S BAKERY	36	RANCHO DEL CAMPO WATER SYSTEM
12	GUATAY MUTUAL BENEFIT CORP.	37	RANCHO ESTATES MUTUAL WATER CO
13	H & J WATER CO.	38	RANCHO SANTA TERESA MW CO.
14	HARBISON CANYON ESTATES	39	RICHARDSON BEARDSLEY PARK INC.
15	HEAVENLY OAKS	40	SAN PASQUAL ACADEMY
16	JULIAN YOUTH ACADEMY	41	SPENCER VALLEY SCHOOL
17	LAKE HENSHAW WATER CO.	42	STUART WATER CO.
18	LAKE MORENA TRAILER RESORT	43	SUNRISE ESTATES MW CO.
19	LAKE MORENA VIEWS MW CO.	44	TECATE VISTA MUTUAL WATER CO.
20	LAKE WOHLFORD RESORT	45	TWIN LAKES RESORT
21	LAZY H MUTUAL WATER CO.	46	WARNER SPRINGS RANCH
22	LIVE OAK SPRINGS WATER COMPANY	47	WARNER UNIFIED SCHOOL DIST.
23	LOS TULES MUTUAL WATER CO.	48	WILLOWSIDE TERRACE WATER ASSOC
24	MOUNT LAGUNA IMPROVEMENT ASSN.	49	WYNOLA WATER DISTRICT
25	MOUNTAIN EMPIRE HIGH SCHOOL	50	YMCA CAMP MARSTON/RAINTREE

N

0 2.5 5 10
Miles

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County of San Diego, Department of Environmental Health, Small Water Systems dataset, San Diego County Water Authority Member Agencies, Available: http://www.sangis.org/Download_GIS_Data.htm
** The City of National City and South Bay Irrigation District have formed a joint powers authority, the Sweetwater Authority, to provide water supply within their jurisdictions.*
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\AdminDraftMaps\060713_JD\Fig3-14_Water Agency Boundaries 060713.mxd

Table 3-25 presents a list of water systems within the Region that are supported by special districts or the County. In addition to the community water systems operated or supported by the County or special districts, nearly 200 mutual water companies provide water service (derived from local groundwater supply) to small communities within the Region. Table 3-26 presents mutual water companies within the Region that serve more than 200 service connections.

Tribal Nations within the Region are generally located on lands east of the Water Authority's service area and are dependent on local sources of water (primarily groundwater). The Rincon Band of Indians receives deliveries from Lake Henshaw, which stores both natural runoff and groundwater pumped from the Warner Basin. Their share of deliveries from Lake Henshaw is dependent on hydrologic conditions, as the groundwater is reserved for Vista Irrigation District and the City of Escondido.

Table 3-25: District-Operated Water Systems outside the Water Authority Service Area with More Than 200 Connections

HU[1]	Watershed	District	Community	Number of Connections[2]	Water Source
903	San Luis Rey River	Mootamai Municipal Water District	Pala-Pauma	0[3]	Local groundwater
		Pauma Municipal Water District	Pala-Pauma	0[4]	Local groundwater
		San Luis Rey Municipal Water District	Fallbrook Valley Center Pala-Pauma	0[5]	Local groundwater
905	San Dieguito River	Questhaven Municipal Water District	San Dieguito	18	Local groundwater
907	San Diego River	Cuyamaca Water District	Cuyamaca	125	Local groundwater
		Julian Community Service District	Julian	188	Local groundwater
		Majestic Pines Community Service District[6]	Julian	695[6]	Local groundwater
		Wynola Water District	Julian/Wynola	63	Local groundwater
909	Sweetwater	Descanso Community Service District	Descanso	315	Local groundwater
911	Tijuana River	County of San Diego (Campo Water and Sewer Maintenance District)	Campo	45	Local groundwater

1 Numerical watershed (hydrologic unit) designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
2 Estimated number of connections as of 2011, per San Diego Local Agency Formation Commission (2011).
3 The Mootami Municipal Water District does not directly provide water. The district's operations are limited to protection of groundwater and riparian water sources. Water users within the district are served by privately-owned Pauma Valley Water Company or private wells.
4 The Pauma Municipal Water District does not directly provide water. The district manages water rights protection efforts and coordinates engineering activities related to water supply. All water within the district is obtained from private wells.
5 The San Luis Rey Municipal Water District is not authorized to provide water. The district funds activities to protect water and water storage rights of private owners.
6 A portion of the Majestic Pines Community Service District is within the Colorado River Basin, and is located outside the IRWM Plan region. Data are not available on the number of these customers that are inside the Region's boundaries.

Table 3-26: Mutual Water Company Systems outside the Water Authority Service Area[1]

HU[2]	Watershed	Water Company	Community	Number of Connections	Water Source
903	San Luis Rey River	Rancho Pauma Mutual Water Company	Pala-Pauma	396[3]	Local groundwater
907	San Diego River	Pine Hills Mutual Water Company	Julian/Pine Hills	465[4]	Local groundwater
		Pine Valley Mutual Water Company	Pine Valley	691[5]	Local groundwater
911	Tijuana	Lake Morena Oak Shores Mutual Water Company	Lake Morena	205[6]	Local groundwater

1 Mutual water companies with more than 200 service connections servicing areas outside the Water Authority service area. Water systems with more than 200 service connections are regulated by the California Department of Public Health.
2 Numerical watershed (hydrologic unit) designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 Pauma Valley Community Services District. Available: http://www.paumavalleycsd.com/waterdist.php. Accessed 14 May 2013.
4 Number of people served. Total number of connections not available. New York Times.16 May 2012. Available: http://projects.nytimes.com/toxic-waters/contaminants/ca/san-diego/ca3700905-pine-hills-mututal-water-company. Accessed 14 May 2013.
5 Pine Valley Mutual Water Company. Available: http://www.pinevalleywater.org/company-history.html. Accessed 14 May 2013
6 *2007 San Diego IRWM Plan.* Available: http://sdirwmp.org/2007-irwm-plan

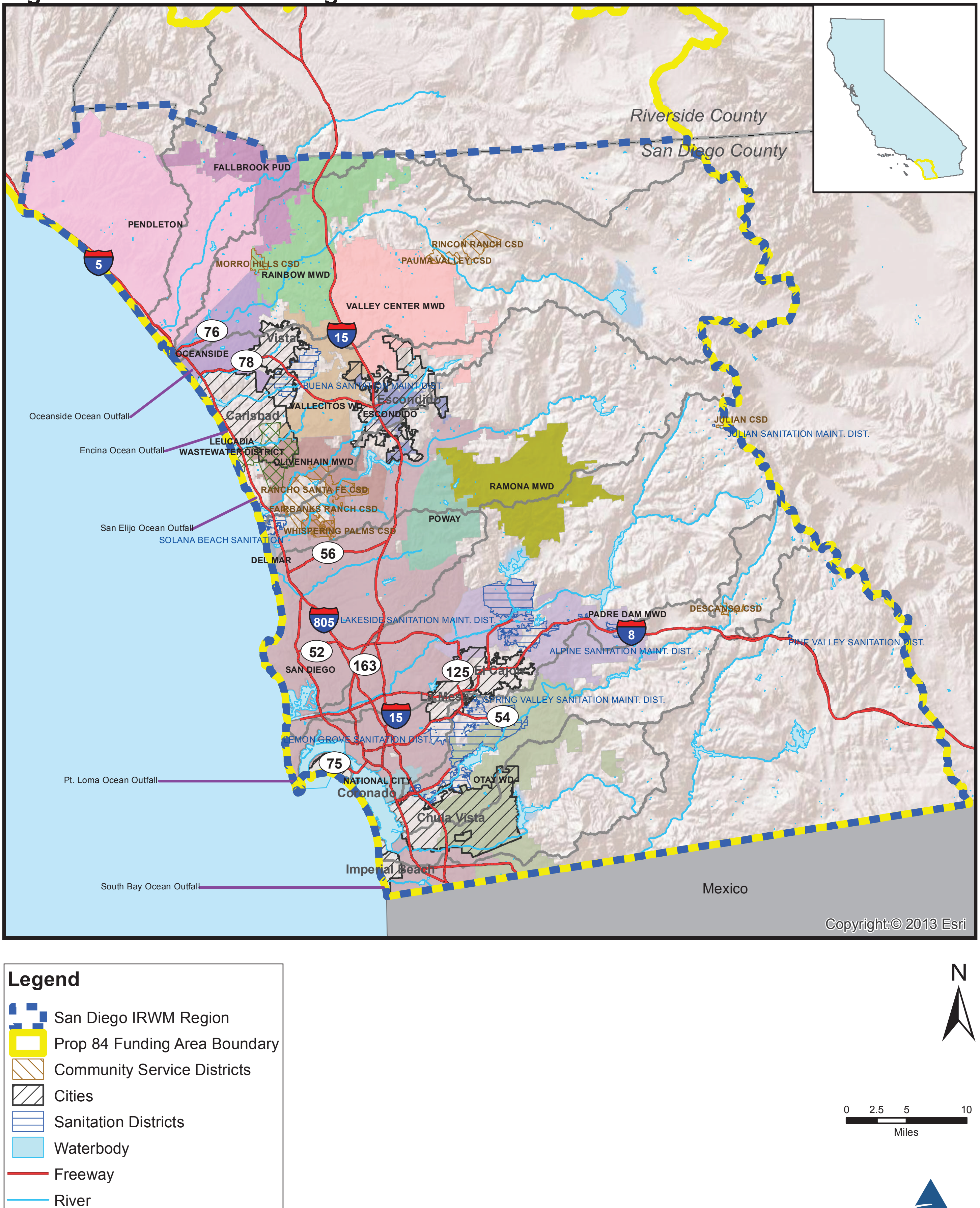
3.6.3 Wastewater Agencies

Municipalities and special districts provide wastewater service within the urbanized portion of the Region. Figure 3-17 presents wastewater agencies within the Region.

Section 3.5.4 presents a general description of the Region's wastewater infrastructure. The Region's urban wastewater agencies have organized (both through the formation of joint powers authorities and through interagency contracts) into five multi-jurisdictional wastewater systems based around the Region's five deep-water ocean outfalls. These include:

1. *Oceanside Ocean Outfall*. Fallbrook Public Utility District and USMC Base Camp Pendleton (southern portion of the base) have connected to the City of Oceanside system (via contract) to form an interconnected regional wastewater system in North San Diego County.
2. *Encina Ocean Outfall*. North County agencies that comprise the Encina Wastewater Authority (a joint powers authority [JPA]) include the Buena Sanitation District, City of Carlsbad, City of Encinitas, Leucadia County Water District, Vallecitos Water District, and City of Vista.
3. *San Elijo Ocean Outfall***.** The City of Escondido and San Elijo JPA jointly own the San Elijo Ocean Outfall. The San Elijo JPA is comprised of the City of Solana Beach, Cardiff Sanitation District, Olivenhain Municipal Water District, and Rancho Santa Fe Community Services District.
4. *Point Loma Ocean Outfall*. The Metropolitan Wastewater Sewer is operated by the City of San Diego on behalf of the Cities of Chula Vista, Coronado, Del Mar, El Cajon, Imperial Beach, La Mesa, National City, Poway, and San Diego, San Diego County, the Otay and Padre Dam Water Districts, and the East Otay, Lemon Grove, Alpine, Lakeside, Spring Valley, and Winter Gardens Sanitation Districts.
5. *South Bay Ocean Outfall*. The City of San Diego and the U.S. Government jointly own the South Bay Ocean Outfall.

Figure 3-17: Wastewater Agencies



San Diego County Water Authority Member Agencies, Community Service Districts & Sanitation Districts, Available: http://www.sangis.org/Download_GIS_Data.htm
Note: City utility districts are based on their municipal boundaries. Data to show their actual sanitation district boundaries do no currently exist, so there may be some overlap.
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\AdminDraftMaps\060713_JD\Fig3-15_Wastewater Agency Boundaries.mxd

In addition to the integrated wastewater systems listed above, a number of the Region's wastewater and recycled water agencies have entered into agreements to construct and operate joint facilities, share use of facilities owned by one or more entities, purvey recycled water to one another, address wastewater and recycled water service areas and responsibilities, share or assign industrial waste pretreatment responsibilities, conduct required monitoring, and mutually share resources during emergencies.

Special service districts provide wastewater service in less urbanized areas of the Region, including the communities of Whispering Palms, Valley Center, Fairbanks Ranch, Ramona, Rancho Santa Fe, and Pauma Valley. Sanitation districts operated by the County provide wastewater service to such inland communities as Julian, Pine Valley, and Campo. Local Tribes provide wastewater service within their respective reservation boundaries. Wastewater service outside of these districts is provided by onsite wastewater (septic) systems.

3.6.4 Stormwater Agencies

As noted previously, the MS4 Permit (Order No. R9-2013-0001) regulates stormwater, non-stormwater, and urban runoff within the Region. The current MS4 Permit (adopted in May 2013 and amended in 2015) shifts the emphasis of stormwater management more to watersheds. Copermittees implement stormwater programs on a watershed basis following the boundaries of the Watershed Management Areas (WMAs). Each Copermittee is responsible for operating its own stormwater/urban runoff management program, consistent with the approved WQIPs, within its respective jurisdiction.

The 21 Copermittees from the San Diego IRWM Region named in the MS4 Permit include:

- City of Carlsbad
- City of Chula Vista
- City of Coronado
- City of Del Mar
- City of El Cajon
- City of Encinitas
- City of Escondido
- City of Imperial Beach
- City of La Mesa
- City of Lemon Grove
- City of National City
- City of Oceanside
- City of Poway
- City of San Diego
- City of San Marcos
- City of Santee
- City of Solana Beach
- City of Vista
- County of San Diego
- San Diego Unified Port District
- San Diego County Regional Airport Authority

In 2004, the County formed Project Clean Water (www.projectcleanwater.org) to address region-wide watershed issues through participation of a broad range of governmental agencies, non-governmental agencies, and regulators. As part of Project Clean Water, the Technical Advisory Committee (TAC) was formed in 2004 to discuss and coordinate a range of watershed planning and implementation issues. The TAC is also provided substantial input on the SWCFS, completed in 2018. The Stormwater Capture and Use Feasibility Study is available on the Project Clean Water website (http://www.projectcleanwater.org/stormwater-capture-and-use-feasibility-study/).

Previous versions of the MS4 permit listed the County as Principal Permittee. In this role, the County coordinated with the County’s 18 municipalities, the Unified Port District, and the Regional Airport Authority in the development and implementation of stormwater monitoring programs and plans. Starting with the 2013 MS4 permit, the role of Principal Permittee was eliminated, and subsequent amendments to the permit incorporated all 39 agencies in Regional Water Quality Control Board Region 9 (this includes Copermittees from San Diego County, south Riverside County, and south Orange County) into the same permit. Copermittees are required to organize on a watershed scale for coordination and planning of stormwater programs via WQIPs developed for each watershed. However, given the nature of water management and jurisdictions in the Region and the fact that regional coordination on stormwater management will continue to be critical, the County continues to play a central role in facilitating coordination of stormwater management.

3.6.5 Flood Control Agencies

The San Diego County Flood Control District (FCD) is the key flood control agency in the County. The FCD (which is governed by the elected Supervisors of the County) establishes flood policies, maintains flood control facilities, operates a regional flood warning system, and is charged with protection of watercourses, watershed management, and protection of water quality.

The different agencies responsible for floodplain management within the region include:

- County of San Diego
- City of Carlsbad
- City of Chula Vista
- City of Coronado
- City of Del Mar
- City of El Cajon
- City of Encinitas
- City of Escondido
- City of Imperial Beach
- City of La Mesa
- City of Lemon Grove
- City of National City
- City of Oceanside
- City of Poway
- City of San Diego
- City of San Marcos
- City of Santee
- City of Solana Beach
- City of Vista

The FCD's role is to provide for the control of the flood and storm waters of the District, and of the flood and storm waters that flow into the District. The FCD's role also includes preserving such waters for beneficial use such as water supply, groundwater percolation, recreation, and environment, and to protect the land, properties, facilities, and people within the District from damage caused by storm and flood waters. The FCD has an adopted Floodplain Management Plan for the County unincorporated area which assesses the flood hazards, summarizes the current flood management program, describes mitigation strategies, and provides a future action plan (FCD, 2007).

North end of El Capitan Reservoir, showing flooded trees.
Photo credit: Jeff Pasek, City of San Diego

As listed above, the eighteen cities within the Region also have floodplain management responsibilities, which are similar to those of the FCD, but are only applied within that city's jurisdictional boundaries. Although the FCD spans the entire unincorporated portion of the County, no single entity within the Region currently coordinates floodplain management between the different floodplain managers.

3.6.6 Groundwater Management Agencies

Under the Sustainable Groundwater Management Act of 2014 (SGMA), water supply agencies that use a medium or high priority groundwater basin are required to form Groundwater Sustainability Agencies (GSAs) to develop comprehensive Groundwater Sustainability Plans (GSPs). Within the San Diego IRWM Region, are two medium priority groundwater basins and three GSAs. All other groundwater basins in the Region are designated as "Very Low" priority and are not currently organized under SGMA. Table 3-27 identifies the groundwater basins for which a GSA has formed, as well as which entities are members of the GSA. *Section 3.5.6* contains additional detail on the groundwater basins located within the Region.

Table 3-27: Groundwater Sustainability Agencies in the San Diego IRWM Region

Groundwater Basin	CASGEM Priority	Designated Monitoring Entity	GSA Name	GSA Members
San Luis Rey Valley[2]	Medium	County of San Diego	Pauma Valley GSA	County of San Diego, Pauma Valley Community Services District, Yuima Municipal Water District, and Upper San Luis Rey Resource Conservation District
San Pasqual Valley	Medium	City of San Diego	San Pasqual Valley GSA	County of San Diego and City of San Diego
San Diego River Valley	Very Low[1]	City of San Diego	San Diego River Valley GSA	County of San Diego, City of San Diego, Lakeside Water District, and Padre Dam Municipal Water District

1 Originally classified as a Medium priority basin, DWR in January 2019 reclassified this basin as Very Low priority, after the GSA had formed.
2 As of July 2018, Senate Bill AB 1994 was being considered by the California State Legislature. AB 1994 would divide the San Luis Rey Valley Groundwater Basin into an upper and lower subbasin, each of which would be designated as Medium priority under CASGEM. As of May 2019, DWR's draft prioritization does divide this basin into upper and lower, with the lower subbasin designated as Very Low priority, and upper subbasin classified as Medium priority.

3.6.7 Environmental Organizations

In addition to the above-noted federal land managers, many private foundations and conservancies have been established within the Region to preserve lands and to provide environmental management of conserved lands. Foundations or conservancies that provide environmental management of lagoons include: Batiquitos Lagoon Foundation, Buena Vista Lagoon Foundation, Agua Hedionda Lagoon Foundation, San Elijo Lagoon Conservancy, Los Peñasquitos Lagoon Foundation, and San Dieguito River Valley Land Conservancy.

Additional conservancy groups involved in conservation, research, resource conservation, and/or environmental management, in part, include: CoastKeeper, Southern California Coastal Water Research Project (SCCWRP) San Diego Task Force, The Nature Conservancy, Trust for Public Land, Escondido Creek Conservancy, Cottonwood Creek Conservancy, Fallbrook Land Conservancy, Bonsall Conservancy, Preserve Calaveras, Iron Mountain Conservancy, Back Country Land Trust, San Diego River Park Foundation, San Diego River Conservancy, Lakeside River Park Conservancy, Groundwork San Diego-Chollas Creek, Living Coast Discovery Center, San Diego Habitat Conservancy, and Resource Conservation District of Greater San Diego County. The San Diego Conservation Resources Network is a network that assists in coordinating efforts among the Region's conservancy groups.

Finally, as climate change science has evolved, the San Diego IRWM Program has connected with climate change organizations, including the Climate Science Alliance and San Diego Regional Climate Collaborative, which work to build a network of scientists, leaders, educators, artists, and others to expand understanding of the effects of climate change on the Region. The San Diego IRWM Program has recently begun participating in dialogues about adaptation and mitigation strategies to address these impacts, specifically as they affect water resources.

3.7 Water Quality

The following sections focus on water quality for the Region's various water resources. Water quality management and regulations pertaining to stormwater are described above in *Section 3.5.8*. Per Assembly Bill (AB) 1249, nitrate, arsenic, perchlorate, and hexavalent chromium are considered priority contaminants. Of the four constituents called out in AB 1249, nitrate is identified as an issue in the Carlsbad Watershed for surface water and the San Juan, San Luis Rey River, and San Dieguito River Watersheds for groundwater. Perchlorate was identified as an issue in the Tijuana River Watershed surface water.

3.7.1 Imported Water Quality

Imported water provided to the Water Authority by Metropolitan is a blend of water from the SWP and Colorado River. The quality of imported supply provided at any time is a function of hydrologic conditions in Northern California and the Colorado River basin, and the blend of water between the two sources.

Total Dissolved Solids (TDS) concentrations in the Colorado River supply have varied significantly during the past 30 years depending on hydrologic conditions. Peak TDS concentrations in the Colorado River supply have exceeded 900 milligrams per liter (mg/L) during sustained years of below-normal runoff within the basin, while TDS concentrations approaching 525 mg/L have occurred after sustained years of above-normal runoff. Colorado River TDS concentrations have averaged approximately 650 mg/L under normal water years (Water Authority 2016a). During the recent drought, however, TDS levels at Lake Havasu on the Colorado River reached 626 mg/L (June 2015), and imported water purchased from Metropolitan exceeded its salinity objective of 500 mg/L from 2013-2015 (Metropolitan, 2016).

SWP supplies typically comprise a smaller percentage of the imported supply provided to the Water Authority, but TDS concentrations in the SWP supply are typically lower than those of Colorado River supplies, historically ranging from more than 425 mg/L to less than 300 mg/L.

While SWP supplies have lower TDS concentrations than Colorado River supplies, concentrations of nutrients (nitrogen and phosphorus) are higher in SWP supplies than in Colorado River supplies. Total nitrogen concentrations in the imported water provided by the Water Authority have ranged from 0.05 mg/L to 1.1 mg/L (as N), with the low values occurring during times when Colorado River supplies comprise a significant portion of the Region's imported supply (Flow Science, 2012). Total phosphorus concentrations in the imported supply have ranged from less than 0.005 mg/L to 0.08 mg/L (Flow Science, 2012).

Of the priority contaminants identified in AB1249, only arsenic is detected in imported water with any consistency. Arsenic in Colorado River supplies range from not detected to 3.5 mg/L, which can be further reduced during treatment. SWP supplies have detected slightly higher levels of arsenic, from not detected to 4.0 mg/L. The greatest source of arsenic in imported water is suspected to be from the use of groundwater storage, as arsenic can be naturally occurring in some water-bearing formations. Elevated arsenic associated with groundwater can be managed through treatment before delivery to customers, as well as blending with supplies lower in arsenic. Perchlorate levels in imported supplies are generally low, with levels not detected in Colorado River supplies since 2012. Chromium-6 is monitored by Metropolitan but has not been detected at levels high enough to require reporting in its Colorado River supplies (Water Authority, 2016a).

3.7.2 Surface Water Quality

Designated Beneficial Uses

The Basin Plan designates beneficial uses for streamflow and surface waters, coastal waters, and reservoir and lake resources within the Region's eleven watersheds. Appendix 3-A presents these beneficial use designations as documented in the Basin Plan for each watershed. 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 eleven watersheds 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 ten of the eleven watersheds.

Surface Water Quality Standards

The Basin Plan (San Diego Water Board, 1994) establishes numeric and narrative water quality objectives to protect designated beneficial uses of inland surface waters and coastal waters. Appendix 3-B presents Basin Plan numerical water quality objectives for the Region. 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.

> ***Basin Plan Surface Water Nutrient Standards***
>
> The San Diego Regional Board is the only one of the nine California Regional Boards to interpret narrative Basin Plan Objectives as numerical concentration standards for nitrogen and phosphorus in surface waters. The San Diego Basin Plan standard for phosphorus is 0.025 mg/L for standing bodies of water and 0.05 mg/L for flowing waters. The original 1976 San Diego Region Basin Plan cited historic nutrient-related biostimulation impacts to San Diego County's coastal lagoons as part of the justification for establishing the numerical phosphorus and nitrogen standards. The 1976 nutrient standards have been maintained in the current (1994) version of the Basin Plan. However, the San Diego Regional Board has indicated that they may consider narrative interpretation of nutrient objectives in the future.

As shown in Appendix 3-B, 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 San Diego Water Board currently interprets these narrative objectives as numerical concentration standards. As a result of the 2014 Basin Plan Triennial Review, the San Diego Water Board is working to incorporate watershed-wide narrative biological objectives for water bodies, in addition to numeric measures to interpret the narrative objective based on water body type.

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 San Diego Water 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 State Board 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. 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 stormwater permit requirements, as well as local planning protocols.

Section 303(d) Listed Waters

Per Section 303(d) of the Clean Water Act, the San Diego Water 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. Appendix 3-C presents 303(d) impaired water body listings for the Region's streams and rivers (Table C-1), lakes and reservoirs (Table C-2), and coastal/marine waters (Table C-3 and Table C-4). Figure 3-18 shows the location of impaired water bodies within the region.

303(d) Impairment and Imported Water Reservoirs

A number of the Region's reservoirs are predominantly used for imported water storage, including Miramar, San Vicente, Murray, Jennings, and Sweetwater, and Otay Reservoirs. The Regional Board has listed several of the imported water storage reservoirs (see Appendix 3-C) as being on the State's 303(d) list of impaired water bodies for exceedance of water quality objectives that are based on drinking water secondary standards (MCLs); specifically for color, manganese, pH, iron, sulfate, and chloride. These listings require that TMDLs be developed to assure attainment of drinking water secondary standards in the reservoirs themselves. These goals cannot be achieved as many of these exceedances are the result of natural conditions.

While local water suppliers agree that water at the tap should be regulated and treated so that it complies with the secondary standards at the point of use, enforcing drinking water secondary standards in the environment does not enhance beneficial uses within these water bodies nor does it improve the quality of municipal water supply at the tap. Maintaining water quality in these reservoirs at levels which occur naturally would balance costs (both economic and environmental) with benefits to beneficial uses.

Lower Otay Reservoir
Photo Credit: Jeff Pasek, City of San Diego

Table 3-28 summarizes 303(d) listings for inland surface waters of the Region. As shown in this table, 72 inland surface water bodies are currently designated as not attaining applicable water quality objectives (State Board, 2014). 303(d)-listed impaired inland surface waters are found in each of the Region's eleven watersheds. Two watersheds have waters impaired by one of the priority constituents identified by AB1240: Carlsbad Watershed for nitrate and Tijuana River Watershed for perchlorate. Refer to Appendix 3-C for a complete listing of impaired waters.

Figure 3-18: Impaired Water Bodies in the San Diego IRWM Region

Source: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\AdminDraftMaps\060713_JD\Fig3-1_Overview of Regions Watersheds_060713.mxd

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Table 3-28: Summary of 303(d) Listings for Inland Surface Waters[1]

HU	Watershed	# of Listed Streams & Rivers[1,2]	# of Listed Reservoirs & Lakes[1,3]	Impaired Water Parameters within Listed Streams, Rivers, Lakes or Reservoirs[1,4]		
901	San Juan	10	0	• Benzo(b)fluoranthene • Cadmium • Chloride • DDE • Diazinon • Dieldrin	• Indicator bacteria • Nickel • Nitrogen • Phosphorus • Sediment toxicity	• Selenium • Sulfates • Total dissolved solids • Toxicity • Turbidity
902	Santa Margarita River	11	0	• Chlorpyrifos • Copper • Diazinon • E. Coli • Enterococcus	• Fecal coliform • Iron • Manganese • Nitrogen	• Phosphorus • Sulfates • Total dissolved solids • Toxicity
903	San Luis Rey River	3	1	• Chloride • Enterococcus • Eutrophic	• Fecal coliform • Nitrogen • Phosphorus	• Selenium • Total dissolved solids • Toxicity
904	Carlsbad	8	1	• Ammonia • DDE • DDT • Enterococcus • Fecal coliform • Manganese	• Nitrate and nitrite • Nitrogen • Nutrients • Phosphate • Phosphorus	• Sediment toxicity • Selenium • Sulfates • Total dissolved solids • Toxicity
905	San Dieguito River	6	2	• Aluminum • Chloride • Color • Enterococcus • Fecal coliform • Iron	• Manganese • Mercury • Total Nitrogen as N • Pentachlorophenol • pH	• Phosphorus • Sulfates • Total dissolved solids • Toxicity • Turbidity
906	Peñasquitos	5	1	• Cadmium • Copper • Enterococcus • Fecal coliform • Indicator bacteria	• Lead • Nitrogen • Phosphorus • Sediment toxicity • Selenium	• Total dissolved solids • Toxicity • Turbidity • Zinc
907	San Diego River	5	3	• Ammonia • Benthic community effects • Chloride • Color • Dissolved oxygen	• Enterococcus • Fecal coliform • Manganese • Total Nitrogen as N • pH	• Phosphorus • Selenium • Sulfates • Total dissolved solids • Toxicity
908	Pueblo	3	0	• Copper • Diazinon • Indicator bacteria	• Lead • Phosphorus • Nitrogen	• Trash • Zinc
909	Sweetwater River	3	2	• Aluminum • Dissolved oxygen • Enterococcus • Fecal coliform	• Manganese • Nitrogen • pH • Phosphorus	• Selenium • Total dissolved solids • Toxicity
910	Otay	2	1	• Ammonia • Color • Iron	• Manganese • Nitrogen	• pH • Toxicity
911	Tijuana River	4	2	• Ammonia • Color • Dissolved oxygen • Eutrophic • Indicator bacteria • Manganese • Nitrogen	• Perchlorate • Pesticides • pH • Phosphorus • Sediments • Selenium • Solids	• Surfactants • Synthetic organics • Toxicity • Trace elements • Trash • Turbidity

1 SWRCB *2014 and 2016 California Integrated Report, Clean Water Act Section 303(d) List and 305(b) Report* (2017), approved by USEPA April 2018.
2 See Appendix C-3 (Table C-1) for rivers and streams listed as 303(d) impaired within the Region.
3 See Appendix C-3 (Table C-2) for reservoirs and lakes listed as 303(d) impaired within the Region.
4 Impaired water parameters listed for at least one receiving water within the watershed. See Appendix C-3.

Appendix 3-C also presents impaired water body listings for coastal and marine waters. Each of the Region's eleven watersheds contains at least one coastal water or beach segment that is currently listed as impaired within the Region. None of these coastal waters or beaches are listed for arsenic, nitrate, perchlorate, or hexavalent chromium.

As part of the 303(d) impaired water designations, the San Diego Water Board establishes priorities for conducting TMDL evaluations to identify and implement required actions to bring the water bodies into compliance with applicable standards. Table 3-29 summarizes TMDLs that have been adopted by the San Diego Water Board to date. Table 3-30 summarizes TMDLs that are in progress.

Table 3-29: Adopted TMDLs

HU	Watershed	Receiving Water	Constituent	San Diego Water Board Resolution (Date of Adoption)	Effective Date[1]
901	San Juan	Baby Beach Dana Point	Indicator bacteria	R9-2008-0027 (June 11, 2008)	September 15, 2009
902	Santa Margarita River	Rainbow Creek	Nitrogen & phosphorus	R9-2005-0036 (February 9, 2005)	February 1, 2006
904	Carlsbad	Loma Alta Slough	Phosphorus	R9-2014-0020 (June 26, 2014)	Approval pending[3]
906	Peñasquitos	Los Peñasquitos Lagoon	Sediment	R9-2012-0022 (June 13, 2012)	January 21, 2014
908	Pueblo	Shelter Island	Dissolved copper	R9-2005-0019 (February 9, 2005)	December 2, 2005
		Shelter Island Shoreline Park	Indicator bacteria	R9-2008-0027 (June 11, 2008)	September 15, 2009
		Chollas Creek	Diazanon	R9-2002-0123 (August 14, 2002)	September 11, 2003
		Chollas Creek	Copper, lead, zinc	R9-2007-0043 (June 13, 2007)	October 22, 2008
Various		Project I beaches & creeks[2]	Indicator bacteria	R9-2010-0001 (February 10, 2010)	April 4, 2011

1 After San Diego Water Board approval, the TMDL is approved by the State Water Resources Control Board, State of California Office of Administrative Law), and U.S. EPA. After EPA approval, the effective date of the TMDL becomes the date the TMDL was approved by the California Office of Administrative Law.

2 Includes Pacific Ocean shorelines in the San Joaquin Hills Hydrologic Subarea (901.11), Laguna Beach Hydrologic Subarea (902.12), Aliso Hydrologic Subarea (901.13), and Dana Point Hydrologic Subarea (901.14); Aliso Creek and mouth of Aliso Creek Estuary (901.13); San Juan Creek and mouth of San Juan Creek Estuary (901.27); Pacific Ocean shorelines at the Lower San Juan Hydrologic Subarea (901.27), San Clemente Hydrologic Area (901.3), San Luis Rey Watershed (903.0), San Marcos Hydrologic Area (904.5), San Dieguito Watershed (905.0), and Miramar Reservoir Hydrologic Area (906.1), and Scripps Hydrologic Area (906.3); Tecolote Creek (906.5), Forrester Creek (907.12), Lower San Diego River (907.11/907.12), Pacific Ocean shoreline in the San Diego Watershed (907.0), and Chollas Creek (908.22).

3 Loma Alta Slough is subject to an "alternative" TMDL, in which the MS4 permit is being used to achieve water quality objectives.

Table 3-30: Summary of TMDLs in Progress[1]

HU	Watershed	Receiving Water	Pollutants to be Addressed in TMDLs
902	Santa Margarita River	Santa Margarita River Lagoon	• Nutrients
904	Carlsbad	Loma Alta Slough	• Bacteria • Nutrients
		Pacific Ocean shoreline at Loma Alta Creek	• Bacteria
		Buena Vista Lagoon	• Bacteria • Nutrients • Sediments
		Pacific Ocean shoreline at Buena Vista Creek	• Bacteria
		Lower Agua Hedionda Creek	• Bacteria
		San Elijo Lagoon	• Bacteria • Nutrients • Sediments
		Pacific Ocean at San Elijo Lagoon Outlet	• Bacteria
		San Marcos Creek/Lake San Marcos (Voluntary Agreement)	• Nutrients
906	Peñasquitos	Los Peñasquitos Lagoon	• Sedimentation/ Siltation
907	San Diego River	Famosa Slough and channel	• Nutrients/ Eutrophication
908	Pueblo	Downtown anchorage	• Chlordane • PAH • PCB
		B Street/Broadway Pier	• PAH • PCB • Zinc
		Mouth of Chollas Creek	• Chlordane • PAH • PCB
		Mouth of Paleta Creek	• Chlordane • PAH • PCB
		Mouth of Switzer Creek	• Chlordane • PAH • PCB
911	Tijuana River	Tijuana River and Estuary	• Sedimentation • Trash

1 TMDLs in progress (as of April 2018), as documented on the San Diego Water Board TMDL website located at: https://www.waterboards.ca.gov/sandiego/water_issues/programs/tmdls/tmdlprogress.html.

Additional Constituents of Concern

The MS4 Copermittees coordinate in the development and implementation of a regional watershed-based receiving water monitoring program. Table 3-31 summarizes highest priority water quality conditions identified in the in the 2017 Stormwater Resources Plan (SWRP). The 2017 SWRP incorporated the water quality priorities identified in the WQIPs for each of the watersheds in the San Diego region. These WQIPs reflect the priorities of the watershed as identified by stakeholders, based on understanding of water quality conditions, regulatory priorities, and stakeholder concerns.

Table 3-31: Highest Priority Water Quality Conditions[1]

HU	Watershed Management Area	Water Body	Dry Weather Priority Constituents	Wet Weather Priority Constituents
902	Santa Margarita River[2]	Santa Margarita River Estuary, Warm Springs, Redhawk Channel	• Eutrophication (elevated algal biomass)	• NA
		Rainbow Creek	• Nutrient loading to TMDL waterbody	• Nutrient loading to TMDL waterbody
		Upper and lower Santa Margarita River subareas except Vail Lake, Fallbrook Creek, and Sandia Creek	• Nutrient loading	• NA
903	San Luis Rey River	San Luis Rey River Mouth	• Bacteria	• Bacteria
		Lower San Luis Rey River	• Bacteria	• Bacteria
904	Carlsbad[4]	Loma Alta Slough	• Eutrophic (nutrients)[3]	• NA
		Agua Hedionda Creek	• Riparian Habitat Degradation • Hydromodification Impacts	• Riparian Habitat Degradation • Hydromodification Impacts
		Lower San Marcos Creek - Pacific Ocean Shoreline at Moonlight Beach	• Bacteria	• Bacteria
		Upper San Marcos Creek	• Nutrients	• Nutrients
905	San Dieguito	Pacific Ocean Shoreline at San Dieguito Lagoon Mouth	• Indicator bacteria at San Dieguito River above Lake Hodges	• Indicator bacteria at San Dieguito River above Lake Hodges • Indicator bacteria at San Dieguito River below Lake Hodges
906	Los Peñasquitos	Los Peñasquitos Lagoon	• Freshwater discharges	• Hydromodification, siltation, and sedimentation
		Pacific Ocean Shoreline at Torrey Pines State Beach at Del Mar	• Indicator bacteria (total coliform, fecal coliform, *Enterococcus*)	• Indicator bacteria (total coliform, fecal coliform, *Enterococcus*)
906	Mission Bay	Tecolote Creek Subwatershed	• Indicator Bacteria	• Indicator Bacteria
		Scripps Subwatershed	• Indicator Bacteria	• Indicator Bacteria • Sediment
907	San Diego River	Forester Creek	• Indicator Bacteria	• Indicator Bacteria
		Lower San Diego River	• *Enterococcus* • Fecal coliform	• *Enterococcus* • Fecal coliform
		Pacific Ocean Shoreline, at the San Diego River outlet, at Dog Beach	• *Enterococcus* • Total coliform	• *Enterococcus* • Total coliform
908 909 910	San Diego Bay	Chollas Creek	• Metals (dissolved copper, lead and zinc) • Bacteria	• Metals (dissolved copper, lead and zinc) • Bacteria
911	Tijuana River	Tijuana River	• NA	• Sedimentation/Siltation • Turbidity
		Tijuana Estuary	• NA	• Turbidity

1 Highest priority water quality constituents identified in the San Diego Region Storm Water Resource Plan (County of San Diego, 2017).
2 Highest Priority Water Quality constituents identified in the Santa Margarita Water Quality Improvement Plan currently pending approval by Regional Water Quality Control Board.
3 Temporal extent between May and October
4 Highest Priority Water Quality constituents identified in Carlsbad Watershed Management Area Water Quality Improvement Plan (Mikhail Ogawa Engineering, 2016)

On the basis of the 303(d) listings and region-wide monitoring programs, Table 3-32 summarizes region-wide water quality issues and constituents of concern for inland surface waters and coastal waters of the Region's eleven watersheds. Key water quality issues of interest in the Region include:

> ***Do TMDLs Address Critical Needs?***
>
> In 2010, the San Diego Regional Board adopted a TMDL for indicator bacteria at 20 beaches and creeks in the San Diego County Region (Resolution No. R9-2010-0001). The TMDL was adopted to address routine exceedances of water quality objectives for Enterococcus, fecal, and total coliform bacteria, which are indicators intended to protect primary contact recreation (REC-1) activities like swimming. Although Enterococcus and coliform bacteria are a commonly-used indicator of human pathogens, and can cause illness in recreational users, the presence of indicator bacteria in some of the TMDL's designated water bodies does not present the most critical water quality problem facing beneficial uses. In these cases, the adopted bacteria TMDL has established a de-facto priority for resource allocation within local stormwater programs. Many affected stakeholders have indicated that the implementation actions needed to comply with the TMDL during wet weather events drive costs and resources, diverting attention from other important issues. Use of alternative compliance methods rather than TMDLs would help to resolve resource allocation issues so that implementation actions truly address the most critical water quality and public health issues.

- *Indicator Bacteria*. Elevated concentrations of total or fecal coliform bacteria indicate the potential for elevated concentrations of pathogens. High concentrations of coliform bacteria resulted in beach advisories along each of the Region's watersheds. Table 3-33 summarizes beach advisories and closures during 2011-2013. Observed elevated coliform bacteria concentrations have occurred as a result of stormwater runoff, urban runoff, and sewer spills.
- *Sediment and Turbidity*. Discharges of sediment can adversely impact water clarity, wildlife habitat, and aquatic habitat. Additionally, sediment can adversely affect the hydraulics of lagoons and estuaries, decrease tidal flushing, and contribute to the transport of bacteria. Turbidity can adversely affect aquatic habitats by limiting light penetration and overall aesthetics.
- *Nutrients*. Elevated concentrations of nitrogen and phosphorus can result in algal blooms and impacts associated with emergent and submergent vegetation. Nutrients are of particular concern in watersheds that discharge to coastal lagoons and estuaries, as summer temperatures and lagoon hydraulics that limit tidal flushing may lead to algal blooms and fish kills due to decreased dissolved oxygen levels. Nutrients are also a concern in inland creek and reservoir systems for the same algal bloom concerns, which may occur due to water stagnancy. Nutrients are a concern in potable water reservoirs, as eutrophication reduces reservoir dissolved oxygen, the treatability of supplies, and taste and odor.

> ***Nutrients in Hodges Reservoir***
>
> Hodges Reservoir, a highly eutrophic reservoir, regularly experiences anoxic conditions, which causes the flux of nutrients from the sediment into the water column and reduces overall water quality. Currently, water quality at Hodges Reservoir does not meet the water quality standards to move this local surface water supply into the regional aqueduct system.

- *Salinity*. Concentrations of TDS and dissolved mineral constituents can adversely impact aquatic and wildlife habitat and the usability of waters for municipal and irrigation supply. TDS concentrations in Region surface waters vary significantly, with TDS concentrations being lower during periods of extreme flow and higher during periods of lower flow.
- *Toxic Inorganic Compounds*. Toxic inorganic compounds (e.g., metals, nitrates, cyanide, and unionized ammonia) can adversely impact aquatic habitat, wildlife habitat, and water supply

uses. As no inland point-source discharges of toxic inorganic pollutants exist within the Region, toxic inorganic compounds in the Region's surface waters can be presumed to originate from non-point sources.

- *Toxic Organic Compounds*. Toxic organic compounds (e.g., pesticides and other EPA-designated priority pollutants) can adversely impact aquatic habitat, wildlife habitat, and water supply uses. Since no inland point-source discharges of toxic organic pollutants exist within the Region, toxic organic compounds in the Region's waters can be presumed to originate from non-point sources. Toxic organic compounds that have resulted in 303(d) impairment listings within the Region include benzo(b)fluoranthene, diazanon, dieldrin, DDT, pentachlorophenol, and perchlorate.

Table 3-32: Summary of Water Quality Issues for Surface Waters

HU[1]	Water-shed	WMA	Water Quality Issues/Constituents of Concern[1]										
			Trash & Debris	Fecal Indicator Bacteria	Nutrients	Eutrophication / Dissolved Oxygen	Turbidity	Sediment	Toxic Organics / Toxicity	Metals	TDS	Index of Biotic Integrity	Pesticides
901	San Juan	San Juan		✓	✓		✓		✓	✓	✓		
902	Santa Margarita River	Santa Margarita River		✓	✓						✓		
903	San Luis Rey River	San Luis Rey River		✓	✓	✓			✓			✓	
904	Carlsbad	Carlsbad	✓	✓	✓	✓		✓	✓		✓	✓	
905	San Dieguito River	San Dieguito		✓	✓	✓			✓	✓	✓		
906	Peñasquitos	Los Peñasquitos; Mission Bay		✓	✓	✓	✓	✓	✓	✓	✓		
907	San Diego River	San Diego River		✓	✓	✓					✓	✓	
908	Pueblo[2]	San Diego Bay	✓	✓	✓			✓		✓			✓
909	Sweetwater[2]	San Diego Bay	✓	✓	✓			✓					
910	Otay[2]	San Diego Bay			✓			✓					
911	Tijuana River	Tijuana River	✓	✓	✓	✓	✓	✓			✓		✓

1 Constituent category is either listed as 303(d) impaired within the watershed (see Table 3-28 and Appendix C), or is identified as a high priority wet-weather or dry-weather constituent (see Table 3-31) as part of the 2017 San Diego Region Storm Water Resource Plan (County of San Diego, 2017).
2 Pueblo, Sweetwater, and Otay are monitored and assessed separately, but are all a part of the San Diego Bay Watershed Management Area.

Table 3-33: Summary of Beach Advisory and Closures, 2009-2013[1]

Parameter	Year				
	2013	2012	2011	2010	2009
Total number of samples	3,868	3,501	3,523	3,493	3,905
Number of beach monitoring stations	79	76	90	87	95
Closures					
Tijuana River beach closure days[2]	11	15	218	266	112
Sanitary sewer overflow (SSO) closure days[3]	2	7	67	61	23
Total closure days	13	22	285	327	135
Advisory Days					
Rain advisory days[4]	8	10	70	70	30
Bacterial exceedance advisories[5]	61	27	117	163	254
Precautionary advisory days[6]	12	5	30	40	24
Total advisory days	81	42	217	273	308

1 From San Diego County Department of Environmental Health Annual Beach Monitoring Summaries, 2009-2013.
2 Closure due to Tijuana River flow that may impact or threaten to impact beach water quality.
3 Closure due to reported sewage spill that may impact or threaten to impact beach water quality.
4 Advisory to refrain from water contact within 72 hours of precipitation runoff.
5 Advisory due to exceedance of body contact recreation (REC-1) bacteriological standards.
6 Advisory due to lagoon outlet excavations or localized runoff/discharges that may impact or threaten to impact beach water quality.

3.7.3 Wastewater Quality

Wastewater from municipal agencies within the Region in excess of recycled water demands is treated via secondary treatment and discharged through regional ocean outfalls. Secondary treatment standards require treatment to achieve a monthly average TSS and BOD concentrations of 30 mg/L, but most of the Region's wastewater plants produce secondary effluent that contains concentrations significantly below these limits.

The City of San Diego currently has a Clean Water Act Section 301(h) waiver from secondary treatment requirements for its Point Loma WWTP. Advanced primary treatment at Point Loma WWTP achieves an average TSS concentration of approximately 35 mg/L, slightly above the mandated federal limit. The Metropolitan Sewer System, however, is required to implement additional pretreatment to ensure that concentrations of toxic organic and inorganic pollutants in the Point Loma WWTP discharge are equivalent to secondary treatment.

The Region's ocean outfalls are described in *Section 3.6.3*. All of the Region's ocean outfall discharges comply with California Ocean Plan receiving water standards for toxic constituents. The City of San Diego's Ocean Monitoring Program monitors 120 square miles of ocean for the effects of ocean outfall discharges on marine health and identifies potential threats to public health.

3.7.4 Water Reuse Quality

Non-Potable Reuse

Non-potable reuse water (tertiary-treated recycled water) produced within the Region conforms to the State Board's DDW Title 22 requirements for disinfected tertiary recycled water, which requires disinfection and filtration to achieve:

- a 99.999% removal of indicator poliovirus (or provide equivalent disinfectant dose/contact time to achieve the same),
- median total coliform concentrations of less than 2.2 organisms per 100 milliliters,
- no more than 23 total coliform organisms per 100 ml in more than one sample during any 30 day period, and
- no sample exceeding a total coliform concentration of 240 organisms per 100 ml.

Concentrations of dissolved minerals in the Region's recycled water supplies vary depending on the quality of the source supply. Recycled water TDS concentrations are typically about 250 to 350 mg/L higher than the source water supply, though this difference can be less. For example, recycled water produced in northern San Diego averages TDS levels of 847 mg/L compared to potable water from the Water Authority, which has a TDS between 615 and 650 mg/L.

Table 3-34 summarizes water quality requirements for dissolved minerals that are established by the San Diego Water Board for the Region's recycled water facilities. Recycled water TDS effluent limits typically range from 1000-1200 mg/L. To prevent salinity-related impacts to landscape and agricultural vegetation, most recycled water producers target recycled water TDS concentrations of 1000 mg/L or less. Several of the Region's coastal recycled water facilities include demineralization treatment that can be used during times of high TDS supply water to ensure conformance with recycled water TDS limits, including the Carlsbad WRF, San Elijo WRF, and City of San Diego NCWRP.

Potable Reuse

The water resulting from indirect potable reuse (discussed in detail in *Section 3.5.5*), which is referred to as purified water, is of similar quality to distilled water, containing 15 mg/L of TDS. During the demonstration and pilot study stages of the City of San Diego's Pure Water San Diego, this purified water is discharged to the recycled water system, helping to improve recycled water quality (City of San Diego, 2013a).

Pure Water San Diego

TDS concentrations in advanced treated water from the demonstration phase of Pure Water San Diego averaged approximately 15 mg/L. The one-year demonstration project has led to the advancement of Pure Water San Diego, which was approved by City council in 2014. Pure Water San Diego will be implemented in phases, with the final phase to be completed by 2035. Pure Water San Diego will involve the diversion of wastewater from the Point Loma WWTP to advanced water purification facilities at NCWRP, a future central area facility. Advanced treated water will be conveyed to Miramar Reservoir for surface water augmentation. This diversion of flows to the advanced treated system will reduce flows to the ocean outfall at Point Loma WWTP. The first phase is scheduled to produce up to 15 mgd of water by 2025, with a long-term goal of 83 mgd of water by 2035, providing approximately one-third of San Diego's future drinking water supply.

The City of San Diego Advanced Water Purification Facility is conducting pilot testing for indirect potable reuse.

Photo credit: City of San Diego

Table 3-34: Recycled Water Quality

HU	Recycled Water Agency	Recycled Water Facility (Permit Number)	Permitted Recycled Water Concentration[1] (mg/l) (Average annual value unless noted)				
			TDS	Chloride	Boron	Iron	Manganese
902	Camp Pendleton	Southern Regional (Order R9-2013-0112)	1200[2]	325[3]	0.6[3]	0.3[3]	0.05[3]
		Northern Regional (Order R9-2014-0006)	500	250	0.75	0.3	0.05
903	City of Oceanside	San Luis Rey (Order No. R9-2014-0108)	1200[2]	350[2]	0.5[2]	0.3[2]	0.15[2]
	Fallbrook Public Utility District	Plant No. 1 (Order No. 91-39)	See note[5]	See note[6]	0.5[3]	0.85[3]	0.15[3]
	Valley Center Municipal Water District	Woods Valley Ranch (Order No. 98-09)	1100[2]	300[2]	0.75[2]	0.3[2]	0.05[2]
904	Buena Sanitation District/City of Vista	Shadowridge[7]	1200[4]	300[2]	0.5[2]	0.3[2]	0.07[2]
	Carlsbad Municipal Water District	Carlsbad (Order R9-2016-0183)	1100[2]	350[3]	0.75[2]	0.3[2]	0.1[2]
	Leucadia Wastewater District	Gafner (Order No. 93-41)	1500[4]	500[4]	0.5[2]	0.3[2]	0.05[2]
	Vallecitos Water District	Meadowlark (Order No. 93-23)	1500[4]	500[4]	0.5[3]	0.3[3]	0.05[3]
	City of Escondido	Hale Avenue (Order R9-2015-0026)	1000[2]	300[2]	1.1[2]	0.3[2]	0.1[2]
	County of San Diego/Rincon Del Diablo Municipal Water District	Harmony Grove (Order R9-2012-0054)	1000	300	0.75	0.3	0.05
	San Elijo Joint Powers Authority	San Elijo (Order No. 2000-10)	1200[2]	400[2]	0.75[2]	0.3[2]	0.15[2]
905	Olivenhain Municipal Water District	4-S Ranch (Order R9-2003-0007)	1200[4]	350 daily	0.75[3]	0.85[3]	0.15[3]
	Ramona Municipal Water District	Santa Maria (Order No. R9-2016-01540154)	1000[2]	250[2]	0.5[2]	0.3[2]	0.05[2]
	Rancho Santa Fe Community Services District	Santa Fe Valley (Order No. 92-04)	1500[4]	500[4]	0.5[3]	0.85[3]	0.15[3]
906	City of San Diego	North City (Order No. 97-03)	1200[2]	300[2]	0.7[2]	0.3[2]	0.1[2]
907	Padre Dam Municipal Water District	Padre Dam (Order No. R9-2016-0099)	1000[2]	400[2]	0.6[2]	0.3[2]	0.05[2]
	Ramona Municipal Water District	San Vicente (Order No. R9-2009-0005)	550[2]	145[2]	0.7[2]	0.3[2]	0.06[2]

HU	Recycled Water Agency	Recycled Water Facility (Permit Number)	Permitted Recycled Water Concentration[1] (mg/l) (Average annual value unless noted)				
			TDS	Chloride	Boron	Iron	Manganese
910	Otay Water District	R.W. Chapman (Order No. R9-2007-0038)	1376[3]	440[3]	0.7[3]	0.2[3]	0.03[3]
911	City of San Diego	South Bay (Order No. R9-2017-0023)	1200[3]	260[3]	0.75[3]	0.3[3]	0.05[3]

1 Recycled water effluent quality limit established within the listed San Diego Water Board recycled water permit or waste discharge requirements.

2 Effluent Limit expressed as an annual (12-month) average.

3 Effluent limit expressed as a monthly (30-day) average.

4 Effluent limit expressed as a daily maximum.

5 Recycled water TDS concentration not to exceed potable supply concentration by 450 mg/l.

6 Recycled water chloride concentration not to exceed potable supply concentration by more than 150 mg/l.

7 Shadowridge plant currently not in operation but San Diego Water Board permit remains active.

3.7.5 Groundwater Quality

Under SGMA, the various GSAs in the Region are developing GSPs to sustainably manage the medium priority groundwater basins in the Region. These GSPs will replace the Groundwater Management Plans that were previously developed under AB3030 and require a coordinated approach to groundwater management. Basin prioritization under CASGEM was developed by the State using consideration of basin use, yield, groundwater levels, overdraft status, and quality. Groundwater basins that form a substantial supply source and have water quality issues were given a higher priority than similar basins that did not contribute substantially to supply. While progress is under way on developing GSPs, they are not scheduled for adoption until 2020 and 2021. In addition to a coordinated effort between basin users, the GSP development process requires stakeholder input, generally solicited at a series of public meetings and workshops.

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 supply 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.

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 groundwaters designated for domestic use.

Appendix 3-B presents Basin Plan numerical groundwater quality objectives within the Region. 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.

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 3-35 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. 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 (Water Authority, 1997).
- *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

High TDS and other constituents in groundwater can impact large scale irrigation operations (Torrey Pines Golf Course shown above).

Photo credit: Jeff Pasek, City of San Diego been documented in portions of the San Luis Rey River and San Dieguito River Watersheds (Water Authority, 1997).

- *Iron and Manganese.* Iron and manganese occur naturally in Region's alluvial groundwaters. 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 (µg/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 San Diego Water Board Order to reduce concentrations of dissolved phase petroleum hydrocarbon constituents to attain background water quality conditions by January 31, 2024 (San Diego Water Board, 2016).

In addition to the above constituents, the State has identified arsenic, perchlorate, and hexavalent chromium as priority constituents.

- *Arsenic*. Arsenic is naturally occurring in some groundwater basins and comes from the surrounding rocks and soils. The federal MCL for arsenic is 10 µg/L, with Colorado River supplies having concentrations of between not detected and 3.5 µg/L, and SWP supplies having between not detected and 4.0 µg/L. Groundwater storage and pumping poses the greatest risk of arsenic contamination. Arsenic exposure can lead to cancers, hyperkeratosis, and changes in skin pigmentation (Water Authority, 2016). Although monitored closely, arsenic concentrations in the region's supplies are generally low.

- *Perchlorate.* Perchlorate compounds are found in solid rocket propellant, munition, and fireworks, and is highly mobile in groundwater. The primary health concern of perchlorate is that it causes hypothyroidism. In 2015, the public health goal (PHG) for perchlorate was set at 1 µg/L, which led to a DDW review of the MCL based on the current PHG. A federal MCL is currently being developed. However, perchlorate is not generally a constituent of concern in the Region's groundwater basins.

- *Hexavalent chromium*. Hexavalent chromium is a naturally occurring element found in rocks, soils, plants, and animals, and is also used in electroplating, stainless steel production, leather tanning, textiles manufacturing, and wood preservation. Hexavalent chromium has been shown to cause certain cancers. Effective July 1, 2014, DDW adopted an MCL of 10 µg/L for hexavalent chromium, but that has since been rescinded. The current federal MCL of 100 µg/L is being reevaluated. Similar to perchlorate, hexavalent chromium is not generally a constituent of concern in the Region's groundwater basins.

In February 2009, the State Board adopted Resolution No. 2009-011, which established a statewide Recycled Water Policy. The Recycled Water Policy, last amended in 2013, requires the State Board and the Regional Water Quality Control 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 stakeholder-driven salinity/nutrient management plans (SNMPs) as the appropriate means for identifying and managing salinity and nutrient loads associated with recycled water use. *Chapter 7, Regional Coordination* includes a detailed discussion of the Policy and SNMPs under development within the Region.

Table 3-35: Summary of Water Quality Issues for Principal Groundwater Aquifers[1]

HU[2]	Watershed	HA[2]	Name of Aquifer	TDS Concentration Range (mg/l)	Water Quality Constituents of Concern[3,4]			
					TDS	Nitrate	Iron & Manganese	Toxic Organics
901	San Juan	901.4	San Mateo	400 – 800	✓	✓		✓
		901.5	San Onofre	600 – 1,500	✓	✓		✓
902	Santa Margarita River	902.00	Lower Santa Margarita[4]	600 – 750	✓		✓	✓
903	San Luis Rey River	903.1	Mission	500 – 2,000	✓		✓	✓
			Bonsall	600 – 3,400	✓	✓		
			Moosa Canyon	200 – 900	✓	✓		
		903.2	Pala/Pauma	350 – 1,400	✓	✓		
		903.3	Warner	250 – 350				
905	San Dieguito River	905.1	Lower San Dieguito	1000 - 27,000	✓		✓	
		905.3	San Pasqual	320 – 2,500	✓	✓		
		905.4	Santa Maria	500 – 1,500	✓	✓		
907	San Diego River	907.1	Mission Valley	1000 – 3,000	✓		✓	✓
			Santee/El Monte	500 – 3,000	✓		✓	
909	Sweetwater	909.1	Lower Sweetwater	1700 – 3,100	✓			
		909.2	Middle Sweetwater	300 – 1,400	✓			
911	Tijuana River	911.1	Lower Tijuana	500 – 3,000	✓			
Vary	Pueblo Sweetwater Otay Tijuana River	908.00 909.00 910.00 911.00	San Diego Formation	340 – 12,000	✓			

1 From Water Authority *Groundwater Report* (1997).
2 Numerical watershed (hydrologic unit and hydrologic area) designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 Constituents that have exceeded state or federal drinking water primary or secondary standards in untreated groundwater (prior to treatment).
4 Hexavalent chromium, perchlorate, and arsenic were not identified as issues in any of the Region's groundwater aquifers.

3.7.6 Desalinated Water Quality

As described within *Section 3.5.1*, desalination supply from the 50 mgd capacity Carlsbad Desalination Plant is 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 is stabilized prior to blending into the Water Authority aqueducts. After product water stabilization, TDS concentrations in the desalination supply average approximately 350 mg/L. Table 3-36 summarizes projected quality of the desalination supply from the Carlsbad Desalination Plant.

Table 3-36: Quality of Seawater Desalination Supply

Parameter	Desalination Water Quality Carlsbad Desalination Plant		
	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)	2016 Average Values[3]
Total dissolved solids	350 mg/l	400 mg/l	182 ppm
Boron	0.75 mg/l	1.0 mg/l	0.49 ppb
Bromide	0.5 mg/l	0.8 mg/l	-
Chloride	180 mg/l	210 mg/l	63.83 ppm
Turbidity	0.3 NTU[2]	0.5 NTU[2]	NA

1 Water quality terms incorporated into water purchase agreement between Poseidon Resources and the Water Authority.
2 Nephelometric Turbidity Units
3 Water Quality Report 2016 (CMWD, 2016).

The City of Oceanside's 6.37 mgd capacity Mission Basin Groundwater Purification Facility (MBGPF), Sweetwater Authority's 10 mgd capacity Richard A. Reynolds Groundwater Desalination Facility (Reynolds Facility), and Camp Pendleton's Haybarn Canyon Advanced Water Treatment Plan (AWTP) are the operating brackish groundwater recovery and treatment facilities within the Region.

- **MBGPF** – The MBGPF uses reverse osmosis (RO) to reduce TDS concentrations, granular activated carbon to remove 1,2, 3-trichloropropane (TCP), and a side-stream treatment system to reduce iron and manganese. Product water is blended with 20% share of water direct from the groundwater well field and subjected to additional post-blend treatment to meet drinking water standards (City of Oceanside, 2016).
- **Reynolds Facility** – High TDS concentrations in Sweetwater Authority's brackish water supply are removed through RO, which decreases the TDS concentration from an average 2,200 mg/L to 100 mg/L. The treated water is then blended with other water supplies to bring the TDS concentration back up to 400 to 500 mg/L to prevent corrosion in the distribution mains (Sweetwater Authority, 2016).
- **Haybarn Canyon AWTP** – Haybarn Canyon AWTP is located in the Santa Margarita Watershed. It has a permitted capacity of 3.6 mgd, and uses RO treatment and disinfection to reduce TDS levels to 325 mg/L.

3.8 Environmental Resources

The Region's water resources are closely linked to its environmental and habitat resources. Local water resources support a variety of important habitat and species, but are also affected, both positively and negatively, by the natural environment through which the Region's water resources pass. Environmental services provided by different vegetation communities, such as wetland habitat, can help to improve water quality, while the presence of invasive species can contribute to flooding or have greater water uptake than native species, preventing domestic uses of that water.

The Region's eleven watersheds support many habitat communities and contain more rare, threatened, and endangered plant and animal species than any comparable land area in the continental United States (Pulliam and Babbitt, 1997).

Multiple Habitat and Multiple Species Conservation Programs

The County Multiple Species Conservation Program (MSCP) and Multiple Habitat Conservation Program (MHCP) are being implemented by the County and local jurisdictions to protect these resources. Figure 3-19 presents the boundaries of the MSCP and MHCP areas.

In addition to the 900-square-mile area covered by the MSCP and 175-square-mile area covered by the MHCP, the County is in the process of developing a North County MSCP encompassing approximately 487 square miles in the northwestern portion of the county, and an East County MSCP that addresses habitat needs within a 2,420-square-mile area. Approximately 41% of the MSCP Plan area is developed or urbanized, and about 5% is used for agriculture.

Core biological resource areas and corridors within the City of San Diego portion of the MSCP area that are targeted for conservation include the Otay Lakes Cornerstone Lands, Marron Valley Cornerstone Lands, San Vicente Cornerstone Lands, and San Pasqual/Hodges Cornerstone Lands. Similar linkages and core biological resource conservation lands are addressed within the North and East County habitat protection programs.

While the MSCP and MHCP program are intended to protect habitat of value to the Region and its species, they are not without controversy. There is some disagreement about the effect of MSCP and MHCP programs that locate mitigation projects outside of the general area where an impact occurs. Because these programs establish formal mitigation areas, if the MSCP and MHCP areas are physically distant from the impact area, the mitigation site may be located at a distance from the physical biological impact. Mitigation implemented outside the area of impact or mitigation exportation has been noted as a concern by some IRWM stakeholders, specifically that certain watersheds that do not contain MSCP and MHCP lands may be continually degraded as a result of this practice.

Other IRWM stakeholders hold that, while individual watersheds may be affected, federal and state policies governing no-net-loss of wetlands ensure that regional wetland functions and services will not decrease. Most on-site compensatory mitigation projects yield widely scattered, small, and isolated or "patch" wetlands, which are not buffered by adjacent uses because they are created at an actual project site to compensate only for a particular project's wetland losses. Ultimately, "patch" wetlands probably will fail not only because of their location and size, but because their ecological potential is limited by their separation from broader wetlands ecosystems. Larger mitigation efforts, such as MSCP and MHCP, consolidate resources and create an economy of scale, yielding more efficient wetlands protection. These off-site wetlands systems are more ecologically valuable than the isolated, on-site "patch" wetlands created from individual mitigation efforts. The ecological benefits include: providing a habitat for a larger variety of wildlife; accommodating larger populations of the present species, which prevents inbreeding and promotes species stabilization; and allowing the wetlands to adapt to changes in the ecosystem.

Vegetation Communities

Table 3-37 describes the principal vegetation communities and characteristic species in the Region.

Table 3-37: Summary of Vegetation Communities[1]

Community	Range	Characteristic Vegetation Species
Coastal Sage Scrub	Extends from the coast to approximately a 1,500-foot elevation. Over 70% of the County's coastal sage scrub has been removed by urban development, but the habitat is found in portions of most of the Region's eleven watersheds.	• California sagebrush (*Artemisia californica*) • flat-top buckwheat (*Eriogonum fasciculatum*) • laurel sumac (*Malosmalaurina*) • white and black sage (*Salvia apiana* and *S. mellifera*)
Chaparral	Exists within an elevation range of 1,000 to 5,000 feet. Vegetation survives the prolonged summer drought season through deep root structure, leaves that minimize evaporation losses, and an ability to recover from wildfire.	• manzanita (*Arctostaphylos* spp.) • red shank (*Adenostoma sparsifolium*) • oaks (*Quercus* spp.) • chamise (*Adenostoma fasciculatum*) • California lilac (*Ceanothus* spp.)
Coastal Sage-Chaparral Scrub	Transition community containing species typical of both chaparral and coastal sage scrub	• (See Coastal Sage Scrub and Chaparral)
Grassland	Native and non-native grasslands occur throughout the Region's eleven watersheds. The largest mountain grassland in the County is at Lake Henshaw and Warner Ranch (San Luis Rey River watershed).	• purple needlegrass (*Nasella pulchra*) • wild barley (*Hordeum murinum*) • rip-gut (*Bromus diandrus*) • slender wild oat (*Avena barbata*) • foxtail (*Bromus madritensis*).
Riparian/Wetlands	Occurs along watercourses within each of the Region's eleven watersheds. Consists of tall, open, broadleafed riparian forests, woodlands, and dense, broadleafed riparian thickets. Herbaceous plants dominate the understory.	• willows (*Salix* spp.) • western cottonwood (*Populus fremontii*) • western sycamore (*Platanus racemosa*) • mule fat (*Baccharis salicifolia*) • Douglas mugwort (*Artemisia douglasiana*) • cattails (*Typha* spp.), bulrush (*Scirpus* spp.) • sedges (*Carex* spp.), primrose (*Oenothera* spp.)
Oak Woodlands	Consists of open or closed canopy woodlands dominated by oaks, including coast live oaks.	• coast live oaks (*Quercus agrifolia*) • Engelmann oaks (*Quercus en gelmannii*)
Coniferous Forest	Found at elevations above 3,500 feet in the northeastern portion of the Region, including Palomar State Park, and the Laguna recreation area in Cleveland National Forest.	• Jeffrey pine (*Pinus jeffreyi*) • Coulter pine (*Pinus coulteri*) • California Black Oak (*Quercus kelloggii*) • incense cedar (*Libocedrus decurrens*) • white fir (*Abies concolor*)
Beach/Foredunes	Found along the coast and bay shores, and characterized by stretches of loose, windswept, sandy dunes that vary in width from a few to several hundred feet.	• Beach sun cup (*Cammissionia cheirianthifolia)* • Beach bur (*Ambrosia bipinnatifida)* • Sea rockets (*Cakile maritima)*
Eucalyptus Woodland	Consists of open to dense stands of eucalyptus trees, which are an invasive, non-native species. The understory can include grasslands and chaparral habitats.	• Eucalyptus (*Eucalyptus* spp.)
Disturbed Habitat	Disturbed habitat consists of previously disturbed areas that are either devoid of vegetation (dirt roads/trails) or support scattered non-native species	• wild radish (*Raphanus sativus*) • tumbleweed (*Salsola tragus*) • tocalote (*Centaurea meletinsis*)
Shallow Bay	Includes Mission Bay and portions of San Diego Bay. Shallow bay areas may support some scattered emergent wetland vegetation.	• None - primarily open water

1 Adapted from USFWS and DFW (1998).

Wildlife and Endangered Species

The Region's vegetation communities support a wide array of wildlife species. San Diego County is home to approximately:

- 1,534 total native plant species
- 75 species of reptiles and amphibians
- 140 species of mammals, including 23 species of bats
- 20,000 species of insects
- 492 species of birds, of which about 70 breed within the County

Over 200 plant and animal species in the County are listed as endangered, threatened, rare, or are candidates for listing (USFWS and DFW, 1998). Over half of these species occur in the southwest portion of Region within the MSCP area. Appendix 3-D presents listed species covered under the MSCP and describes their associated habitats. Appendix 3-D also presents non-listed species that occur within the MSCP area that are considered sensitive. Appendix 3-D acknowledges that the federal listing for Southern California steelhead refers to a population ranging from Santa Maria River to San Mateo Creek; despite the federal listing of this population's range, the historical southern boundary of the species' range is the United States-Mexico border.

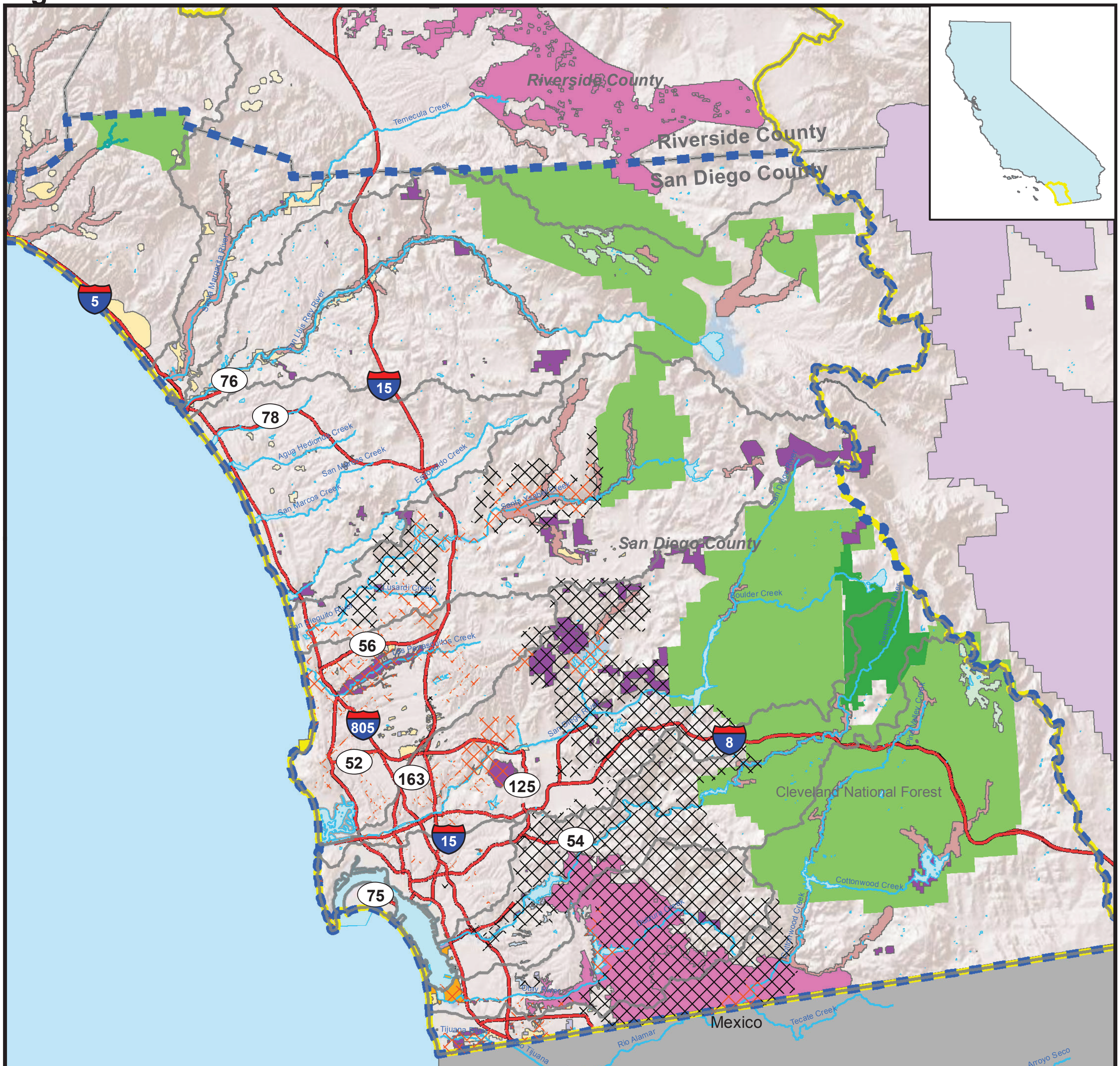
The San Diego River provides an important habitat corridors for native wildlife

Photo credit: Jeff Pasek, City of San Diego

Wildlife corridors and linkages are a key component of the Region's species protection plans. The conservation programs identify primary wildlife corridors/linkages that (1) connect core biological resource areas within the protection plan boundaries; and (2) provide connections to habitat outside the boundaries. As an example, identified linkages in the MSCP include:

- Otay Ranch to Sycuan
- Sweetwater Reservoir to McGinty Mountain
- Interstate-8 at Lakeside
- Dehesa to El Capitan Reservoir
- Boden Canyon

Figure 3-19 : Natural Resources



Legend

Critical Habitat Areas

- Laguna Mountains Skipper Habitat
- Bufo Californicus Habitat
- Thread-Leaved Brodiaea Habitat
- Deinandra Conjugens Habitat
- Least Bell's Vireo Habitat
- Spreading Navarretia Habitat
- Peninsular Big Horn Sheep
- Quino Checkerspot Butterfly Habitat
- Riverside Fairy Shrimp Habitat
- San Diego Fairy Shrimp Habitat
- Southwestern Willow Flycatcher Habitat
- Western Snowy Plover Habitat
- Cuyama State Park
- San Diego Bay National Wildlife Refuge
- SC Steelhead Habitat
- Area of Special Biological Significance
- Cleveland National Forest
- Parks
- City of San Diego Multi-Habitat Planning Area (MHPA)
- San Diego County Multiple Species Conservation Program (MSCP)
- San Diego IRWM Region
- Funding Area Boundary
- County
- Watershed
- Waterbody
- River
- Freeway

0 2.5 5 10

Miles

N

Critical Habitat, USFWS, Available: http://criticalhabitat.fws.gov/Areas of Special Biological Significance, SWRCB, Available: http://www.swrcb.ca.gov/water_issues/programs/ocean/asbs_areas.shtml
Parks, Cleveland Nat'l Forest, MCSP & MHPA, SANGIS, Available: http://www.sangis.org/Download_GIS_Data.htm
L:\Projects GIS\0188-003 SDIRWM Plan Update\MXD\Set 060713\Fig3-16ab_NatResources.mxd

WOODARD & CURRAN

Freshwater Habitat

In addition to the vegetation communities summarized in Table 3-37, vernal pools occur within the Santa Margarita River, Carlsbad, San Dieguito River, Peñasquitos, Otay River, and Tijuana River Watersheds. Vernal pool sites are characterized by fine textured soils underlain by cemented hardpan. Vernal pool vegetation typically consists of a low, herbaceous community dominated by annual herbs and grasses.

The Region's inland surface waters support both warm and cold freshwater aquatic habitats. Common channel flow regimes within the Region include alluvial reaches, with pools, bars, and shallow riffles. Upstream sections of the Region's major watercourses may contain cobble and bedrock reaches. In 1998, the San Diego Water Board implemented a four-year bioassessment program to expand ongoing efforts to assess the integrity of the Region's waters, develop indices of biological integrity, identify reference conditions, and develop baseline data. Assessment work completed to date indicates significant geographic and temporal variation in habitat integrity indices within the Region. The studies recommended designating the lower 25th percentile of reference site data as representing "poor" or "very poor" quality habitat. Monitoring sites with habitat indices in this lower 25th percentile were identified in portions of most of the Region's watersheds (DFW, 1999, 2001, 2002).

Coastal Habitats

Estuarine habitats within the Region include coastal lagoons, seagrass beds, southern coastal salt marsh, and brackish marsh. A wide range of intertidal marine habitats exist along the Region's coast, including: intertidal sandy beach, cobble beach, intertidal platform, intertidal boulder field, tidal pool, and rocky headland. Submerged marine habitats along the Region's coastline include: soft/sand bottom, rocky reef, seagrass beds, surfgrass, and kelp beds.

Many of the Region's estuarine habitats are located within coastal lagoons, which receive water from upstream creeks and rivers and also receive saline water from the Pacific Ocean. Due to their coastal nature, the inlets (openings) to the lagoons may become blocked by sand that is transported by tides, surf, and storm surges (San Elijo Lagoon Conservancy, 2013). In order to maintain connectivity with the ocean, several of the Region's coastal lagoons are dredged on a regular basis. Dredging activities often require excavation equipment to remove sediment and sand accumulations that block lagoon inlets, and can temporarily prevent recreational access to the Region's lagoons. Although impacts from dredging may occur, these activities are considered necessary to maintaining lagoon health and ensuring that the Region's lagoons do not become stagnant for long periods of time (San Elijo Lagoon Conservancy, 2013).

Invasive Species

Non-native invasive vegetation species have become established in portions of all of the Region's watersheds. The non-native invasive vegetation can alter fire frequencies, soil conditions, local hydrology, and reduce the reproductive ability of native vegetation. Once established, the non-native vegetation can displace the native vegetation community and dependent wildlife. Invasive species impacting the Region's riparian community include, but are not limited to, giant reed (*Arundo donax*) and salt cedar (*Tamarix* spp.). Through increased water uptake, these species can lower natural water tables, limit groundwater recharge, and reduce streamflow. In addition to hydrological changes, *Tamarix* leaf litter can sufficiently increase soil salinity such that areas can become unsuitable for native vegetation and dependent wildlife. *Arundo* and *Tamarix* support few insects, the main food supply for insectivorous birds, while limiting or eliminating native vegetation and their associated habitats.

Invasive species also negatively affect aesthetics and recreational access through overcrowding of waterways, excessive water uptake resulting in lower flows in waterbodies used for recreation, and overall decreased quality of native habitat for recreational enjoyment. Other key invasive species within the Region include: iceplant (*Carpobrotus edulis*) and pampas grass (*Cortaderia selloana*). Iceplant occupies significant areas of the Region, including coastal dunes, and can deprive native vegetation of moisture and nutrients. Pampas grass out-competes native vegetation through its aggressive root system. Invasive species eradication efforts are currently underway in many of the Region's watersheds.

Water quality monitoring and invasive removal, such as Arundo Donax, will improve the habitat quality of Chollas Creek.

Photo credit: Travis Prichard, San Diego CoastKeeper

The marine algae *Caulerpa taxifolia* is an invasive species of concern for the Region's coastal and marine waters. *Caulerpa taxifolia* grows as a dense blanket that covers and kills native aquatic vegetation. Once established, *Caulerpa taxifolia* results in the displacement of fish, invertebrates, marine mammals, and sea birds that are dependent on the displaced native marine vegetation (San Diego Water Board, 2006b). In 2000, *Caulerpa taxifolia* was found in Agua Hedionda Lagoon (Carlsbad Watershed). Eradication efforts including chemical treatment, tarping, surveillance, and public outreach efforts were conducted by the Southern California *Caulerpa* Action Team. As a result of these efforts, full eradication of *Caulerpa taxifolia* has been achieved.

The Quagga mussel is a recent invasive species of critical concern within the Region. The Quagga mussel is a small mollusk that can adversely impact the Region's water supply operations and facilities by clogging pumps, clogging water lines, creating taste and odor problems in treated water supplies, and adversely altering ecosystems within the Region's surface water reservoirs. In February 2007, Metropolitan launched a comprehensive program to detect and control an invasion of Quagga mussels within Metropolitan's imported water supply network. Quagga mussels were confirmed in several of the Region's imported water supply reservoirs in August 2007. In 2010, a Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP) was formulated by the Water Authority, along with CDFW and others, to conserve and manage covered species under a comprehensive approach that contributes to the ongoing conservation and management efforts in San Diego County. The plan included a quagga and zebra mussel response and control action plan to control the spread of quagga and zebra mussels in San Diego County.

The gold spotted oak borer (*Agrilus auroguttatus*) as well as polyphagous shot hole borer (*Euwallacea* sp.) and its cousin the Kuroshio Shot Hole Borer, are present in the Region, and contribute to tree death through direct damage to plants as well as the spread of fungi and diseases. Since its introduction from Arizona, the gold spotted oak borer, which was first identified in San Diego County in 2004, had killed 21,500 trees in San Diego County by 2010. Oak death occurs due to damage to the nutrient and water conducting tissues in the trees (UC Cooperative Extension, 2011). The shot hole borers introduce fungi that cause Fusarium Dieback to a variety of host tree species, including willows and sycamores, both of which are riparian species. The loss of trees affects water quality, increases runoff, and changes habitat type and availability for native species.

Invasive species within San Diego Bay represents an additional concern within the Region. Biological surveys conducted by CDFW have confirmed the presence of over 50 non-native species within San Diego Bay (DFW, 2006).

3.9 Recreational Resources

The Region supports a wide array of recreational resources, with 70 miles of recreational beaches, which include:

- Nine California State Beaches: Cardiff, Carlsbad, Leucadia, Moonlight (operated by the City of Encinitas), San Elijo, San Onofre, Silver Strand, South Carlsbad, and Torrey Pines
- Municipal beaches in Oceanside, Encinitas, Solana Beach, Del Mar, San Diego, Coronado, La Jolla, Mission Bay, Mission Beach, Ocean Beach, Pacific Beach, Point Loma, and Imperial Beach

Important coastal preserves and recreational areas include State, county and local parks, beaches and ecological reserves. Table 3-38 presents the larger State and regional recreational areas and ecological reserves within the Region.

As noted, there are two ASBS sites in the region: the La Jolla ASBS and the San Diego-Scripps ASBS. Together, these areas are part of the San Diego-La Jolla Underwater Park. The 6,000-acre underwater park (established by the City of San Diego) stretches from La Jolla Cove in the south to the north end of Torrey Pines Reserve.

The County Department of Parks and Recreation maintains 90 parks and recreational facilities covering over 40,000 acres, including local and regional parks, fishing lakes, community centers, special-use facilities, ecological preserves, and open spaces. The County also operates the County Trails Program that includes (1) a Regional Trails Plan that addresses over 650 miles of existing and planned trails, and (2) a Community Trails Master Plan that addresses over 1,400 miles of new and existing trails.

The City of San Diego maintains a parks system that includes three regional parks, six open space parks, three golf courses and numerous community parks. The City also maintains a lakes recreation program that offers fishing and water contact sports to visitors at nine surface water reservoirs. Additionally, the Region’s other 17 municipalities maintain numerous community parks, regional parks, and open space preserves.

Cleveland National Forest covers significant portions of the Region, including upstream areas of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater, and Tijuana River Watersheds. Mountain area state parks within the Region include Palomar Mountain State Park (San Luis Rey River Watershed) and Cuyamaca Rancho State Park (San Diego and Sweetwater River Watersheds).

Table 3-38: Summary of Regional Parks and Reserves

HU	Watershed	Regional Park or Reserve[1,2,3]
903	San Luis Rey	• Pilgrim Creek State Ecological Reserve • San Luis Rey River Park (land acquisition in progress)
904	Carlsbad	• Agua Hedionda Lagoon State Ecological Reserve • Batiquitos Lagoon State Marine Park • Buena Vista Creek State Ecological Reserve • Buena Vista Lagoon State Ecological Reserve • Carlsbad Highlands State Ecological Reserve • San Elijo Lagoon State Ecological Reserve • San Elijo State Marine Conservation Area • Swami's State Marine Conservation Area
905	San Dieguito	• Boden Canyon State Ecological Reserve • San Dieguito Lagoon State Marine Park and Ecological Reserve
906	Peñasquitos	• Blue Sky State Ecological Reserve • La Jolla State Marine Conservation Area • Matlahuayl State Marine Conservation Area • Meadowbrook State Ecological Reserve • San Diego Scripps State Marine Conservation Area • South La Jolla State Marine Reserve • Torrey Pines State Reserve
907	San Diego	• Famosa Slough State Marine Conservation Area • Mission Trails Regional Park • San Diego National Wildlife Refuge
908	Pueblo	• Cabrillo State Marine Reserve
909	Sweetwater	• Chula Vista Wildlife Reserve • Crestridge State Ecological Reserve • McGinty Mountain State Ecological Reserve • Rancho Jamul State Ecological Reserve • San Diego National Wildlife Refuge • Sweetwater Marsh National Wildlife Refuge • Sweetwater Regional Park • Sycuan Peak State Ecological Reserve
910	Otay	• Otay Mountain State Ecological Reserve • Otay Valley Regional Park • San Diego National Wildlife Refuge • South Bay County Biological Study Area
911	Tijuana	• Border Field State Park • Tijuana National Estuarine Sanctuary • Tijuana River Mouth State Marine Conservation Area • Tijuana River Valley Regional Park • Tijuana Slough National Wildlife Refuge • Walker Canyon State Ecological Reserve

1 List of County of San Diego parks from County of San Diego (2012).
2 List of City of San Diego parks from City of San Diego (2012).
3 List of marine protected areas and preserves adapted from DFW (2012).

3.10 Water Demand and Supply Diversification

Demand Forecasts

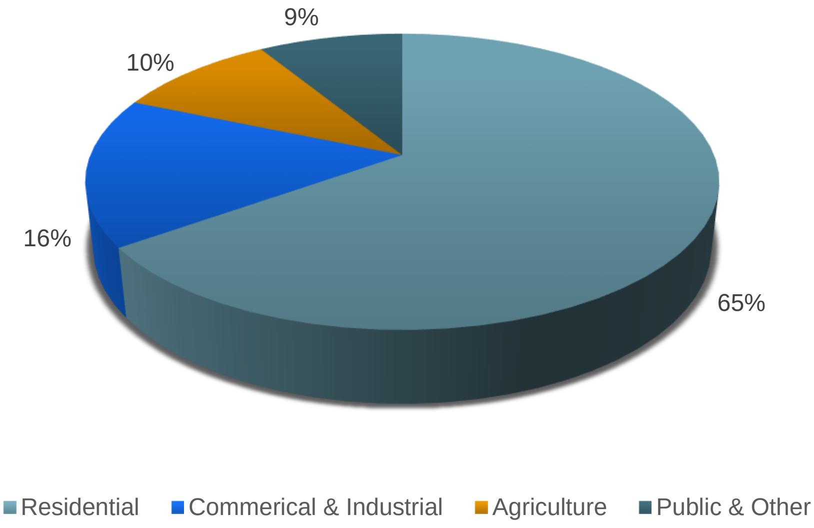
> ***Impact of Drought on Demand***
>
> As a result of the extreme multi-year drought during 2012-2016, water use restrictions and demand management strategies were implemented in the Region to reduce total water demand. With the support of regional water agencies, an average of 73,000 AFY of water was conserved from 2010-2015 when compared to the benchmark year of demand in 1991, when the population was 27% less. For water year 2017 (October 2016-September 2017), water production was approximately 85,000 AF less than in 2013 (SWRCB, 2017). In June 2015, the State Board adopted an emergency regulation that required water suppliers to reduce monthly water use. The regional average water use reduction target was 20%. From June 2015 to February 2016, when the State-mandated water use reductions were in effect, the Region exceeded the regional target with a water use reduction of 22%.
>
> In response to supply cutbacks from Metropolitan, allocation for agricultural program participants were imposed for fiscal year 2016 at 15%, and agricultural production decreased.

Demand for water in the Water Authority's service area includes municipal and industrial (M&I) demand and agricultural demand. M&I demand comprises 92% of regional water consumption and can be subdivided into residential demand and commercial/industrial demand (Water Authority, 2016).

Approximately 80% of the M&I demand is currently for residential use. Residential water consumption includes both indoor and outdoor uses. Indoor water use includes sanitation, bathing, laundry, cooking, and drinking, while most outdoor use is for landscape irrigation. Outdoor residential M&I demands for single family homes may comprise up to 60% of total residential use (Water Authority, 2016a). Industrial water consumption consists of a wide range of uses, including product processing, aggregate washing, concrete batching, dust control, cooling, air conditioning, sanitation, and landscape irrigation. Commercial water demand is typically for sanitation, landscape irrigation, and drinking. Excluding future conservation efforts, M&I demands are projected to increase by 30% between 2015 and 2040. However, per capita potable water use has decreased 39% since 1990 (Water Authority, 2016).

In recent years, agriculture demands have dropped significantly due to several factors, including water supply cutbacks, water rate increases, and economic downturn. Agricultural demand declined 58% between 2007 and 2015, from 98,000 AFY to 41,000 AFY. To comply with the mandatory supply allocations that resulted from drought conditions and judicial restrictions on SWP supply availability, growers implemented various actions that included tree stumping and plant stock reduction. Agricultural water demand now accounts for 8% of the Water Authority’s total water demand. All but a small fraction of the agricultural demand is for irrigation. Primary crops within the Region include avocados, citrus, flowers, and nursery products. Agricultural water use within the Water Authority's service area is concentrated mainly in the northern portion of the Region within the Fallbrook Public Utility District, the City of Escondido, Rainbow, Valley Center, Ramona, and Yuima Municipal Water Districts (Water Authority, 2016a). Figure 3-20 shows FY 2016 water demand by customer sector.

Figure 3-20: FY 2016 Water Demand by Customer Sector Use



Source: Water Authority FY 2016 Annual Report (Water Authority, 2016a)

Because a significant portion of the overall regional water demand is for irrigation, weather and hydrologic conditions (precipitation, temperature, evaporation) have a significant effect on water demands within the Water Authority service area. Population, housing, and employment are also key factors in influencing the regional water demand. Over the last several decades a prosperous economy had stimulated local development and population growth, which in turn produced a relatively steady increase in water demand. However, since the 2000s, the combination of economic recession, drought messaging, implementation of member agency mandatory water use restrictions, water rate increases, and mild local weather culminated in a dramatic multi-year decrease in total water demand. Annual water demand in the Water Authority's service area went from 542,438 AF in fiscal year 2012 to 454,963 AF in fiscal year 2016, a roughly 16% decrease (Water Authority, 2016b).

To forecast future M&I water use, the Water Authority selected the IWR-MAIN (Institute for Water Resources – Municipal and Industrial Needs) computer model. Versions of this econometric model have evolved over a 20-year period and are being used by many U.S. cities and water agencies. The IWR-MAIN system is designed to utilize projections of local population, housing, and employment and other demographic data to forecast M&I water demand. The Water Authority's version of the IWR-MAIN model was modified to reflect the Region's unique parameters and is known as CWA-MAIN.

Per a 1992 Memorandum of Agreement (MOA) between SANDAG and the Water Authority, the Water Authority agreed to use SANDAG's most recent regional growth forecasts for planning purposes. Water demands presented in the Water Authority's *2015 Urban Water Management Plan* were developed using the CWA-MAIN model and the SANDAG *Series 13: 2050 Regional Growth Forecast* (Series 13 forecast). The Series 13 forecast was refined to include the 2010 Census counts and an economic outlook that factored in the "Great Recession." These refinements resulted in slower regional growth in the near term and lower water demands over the long-term planning horizon compared to SANDAG's previous forecast. The CWA-MAIN model was adjusted to incorporate:

- estimated demands for USMC Camp Pendleton that are based on historic trends, and
- a separate agricultural demand model that estimates demand based on projected agricultural acreage, and updated crop distribution and irrigation management data.

Using this modeling approach, Table 3-39 presents projected water demands through 2035 under "normal year" hydrologic conditions.

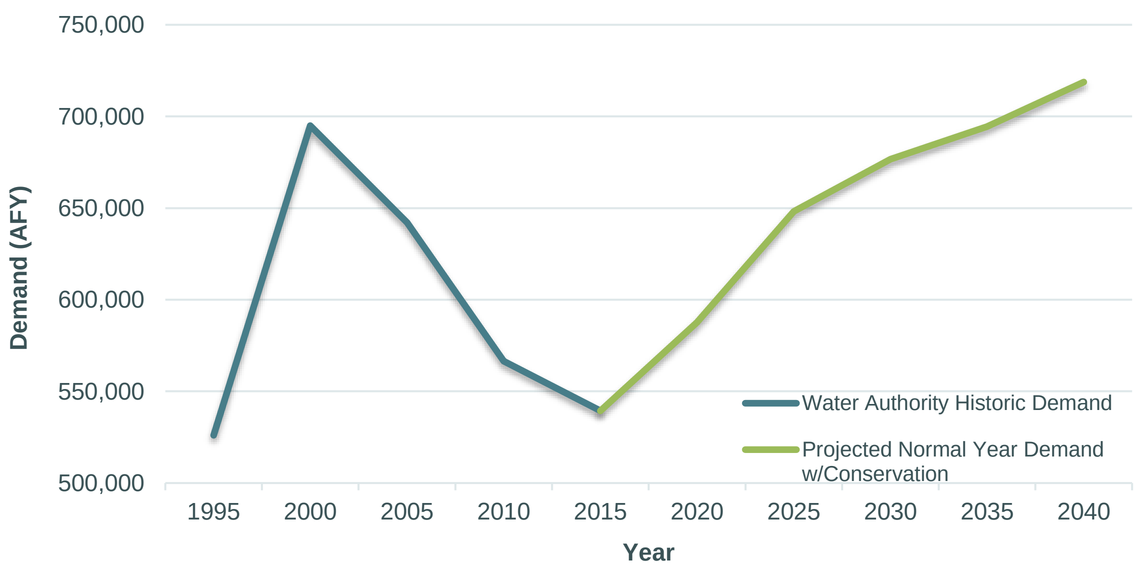
Table 3-39: Normal Year Water Demand Forecast – Water Authority Service Area[1]

Demand Parameter	Projected Water Demand (acre-feet per year)				
	2020	2025	2030	2035	2040
M&I Baseline Forecast[2]	602,100	673,886	715,690	744,370	781,433
Estimated Conservation Savings	74,141	89,110	102,834	114,599	128,222
M&I Forecast Reduced by Conservation	527,959	584,776	612,856	629,771	653,211
Agricultural Forecast	52,961	51,379	49,897	48,460	47,214
Total Projected Demand	580,920	636,155	662,753	678,231	700,425
Total Projected Demand with Pending Annexations and Additional Anticipated Growth	587,581	648,124	676,721	694,431	718,773

1 From *2015 Urban Water Management Plan* (Water Authority, 2016a). Water demand estimates for the portion of the Region outside the Water Authority service area are not available.
2 Includes M&I demands for Camp Pendleton area customers.

Figure 3-21 shows these projected demands alongside historic water demands. As described earlier, the decrease in water demand since 2000 is attributed to regulatory and conservation efforts, as well as the economy, water costs, and home foreclosures. Information presented in Table 3-39 and Figure 3-21 reflects current demand projections presented within the *2015 Urban Water Management Plan* (Water Authority, 2016a).

Figure 3-21: Historic Water Use and Projected Water Demands



Water Supply Diversification

The *California Water Plan Update 2013* (DWR, 2013) identifies short-term and long-term issues that may impact water supply availability and include (in part): population growth, drought, flood, earthquake, aging infrastructure, global climate change, and environmental restrictions. The *California Water Plan Update 2013* promotes diversification of regional water portfolios.

Recognizing that imported SWP and Colorado River supplies are subject to legal, environmental, drought, and other uncertainties, a key result area of the Water Authority's *Strategic Plan* is diversification of the Region's water portfolio. This diversification plan is based on:

- Retail member agency compliance with Senate Bill (SB) x7-7 water conservation targets, requiring 20% reduction in potable water use by 2020.
- The completed Carlsbad Desalination Plant.
- Increasing the amount of recycled water use and brackish groundwater demineralization facility yield implemented by member agencies.
- Full implementation of the IID water transfers.

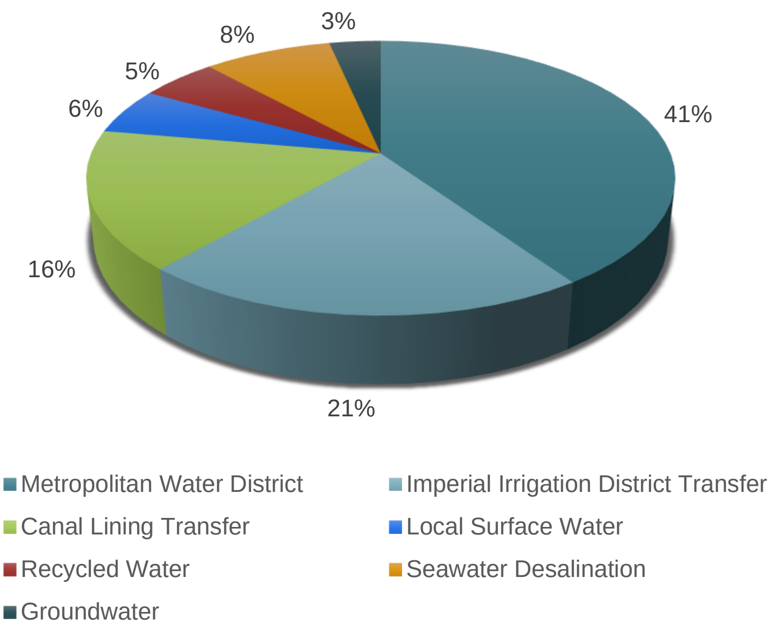
Many of these actions are complete or nearing completion. For example, the Water Authority member agencies are all on track to meeting their SBx7-7 goals, and deliveries of IID water transfers has continued to grow closer to full implementation. Additionally, multiple member agencies are expanding their recycled water systems, and those with groundwater desalination facilities have expanded or are considering expansion of their capacities.

Water conservation is a fundamental component of the Region's water diversification plan. The Water Authority and its member agencies have aggressively supported water conservation since 1990. Significant Water Authority and member agency funding has been directed toward implementing comprehensive conservation programs to reduce water use for residential, commercial, and agricultural irrigation, and to reduce water use in homes, businesses, industries, and institutions.

Water transfers that incorporate water conservation represent another key element of the Water Authority's water supply diversification effort. In 1998, the Water Authority executed an agreement with the IID for the conservation and transfer of agricultural water. Under the agreement, water conserved by Imperial County farmers who participate in a voluntary program would be transferred to the Water Authority. Water transferred to the Water Authority totaled 70,000 AF during 2010 and 100,000 AF in 2015. The quantities will increase annually to a maximum annual total of 200,000 AF in 2021 and remain fixed for the duration of the 75-year transfer agreement.

Additionally, in 2003, the Water Authority contracted rights to 77,700 AFY of water conserved through projects that lined 24 miles of the All-American Canal and 37 miles of the Coachella Canal in Imperial County. An additional amount up to 4,850 AFY is available to the Water Authority depending on environmental requirements associated with the Coachella Canal. For planning purposes, the Water Authority assumes that 2,500 AF of the 4,850 AF will be available each year for delivery, for a total of 80,200 AFY of this supply. Work on the Coachella Canal lining project was initiated in 2004 and was completed in 2006. Work on the All-American Canal began in 2005 and was completed in 2010. Deliveries of conserved water to the Region began in 2007. Figure 3-22 shows FY2017 water supply sources for the Region.

Figure 3-22: FY 2017 Water Supply Sources



Source: Water Authority Website Available: http://www.sdcwa.org/regional-water-supply-reliability

Conserved IID agricultural water and water conserved through the canal lining projects is credited to the Water Authority through a 2003 transfer agreement between the Water Authority and Metropolitan. Under the agreement, Metropolitan takes delivery of conserved IID agricultural and canal-lining water, and Metropolitan, in turn, provides the Water Authority with a like quality and quantity of water.

Other components of the supply diversification effort undertaken by the Water Authority and its member agencies include the following:

- **Groundwater** – Groundwater supplies are developed through management and recovery of good-quality alluvial groundwater or demineralization of poor-quality groundwater. Private wells are used to meet domestic and agricultural water needs within and outside the Water Authority's service area. A lack of groundwater pumping and demand data is a significant water management challenge in rural areas.
- **Seawater Desalination** – The Carlsbad Desalination Plant, built at the Encina Power Station in Carlsbad, delivers 50 mgd of potable water into the regional aqueduct system. The plant is permitted to produce up to 56,000 AFY.
- **Indirect Potable Reuse** – Potable reuse is being pursued by several member agencies as an option for supplementing potable water supplies with highly-treated recycled water. The Pure Water San Diego demonstration facility at the NCWRP is operating at 1 mgd capacity. Padre Dam MWD is expanding the Ray Stoyer WRF by 4 mgd to deliver recycled water for irrigation and to the AWPF for potable reuse. Pure Water Oceanside is a planned 3 mgd AWTF to recharge the Mission Groundwater Basin with purified recycled water. Other agencies are in the conceptual stage of planning potable reuse projects, as described in *Section 3.5.5*.

Taking into account projected water conservation savings, Table 3-40 presents a breakdown of projected water supplies and compares projected supplies with the demand forecast for a normal hydrologic year. As shown in Table 3-40, imported supplies from Metropolitan are projected to comprise approximately 35% of the total regional water demand by year 2040.

Table 3-40: Water Authority Water Supply Portfolio – Normal Water Year[1]

Demand Parameter	Projected Water Supply (acre-feet per year)				
	2020	2025	2030	2035	2040
Water Authority Supplies					
IID Water Transfer[1,2]	190,000	200,000	200,000	200,000	200,000
Canal Lining Projects[1,3]	80,200	80,200	80,200	80,200	80,200
Coachella Lining	*24,000*	*24,000*	*24,000*	*24,000*	*24,000*
All American Lining	*56,200*	*56,200*	*56,200*	*56,200*	*56,200*
Carlsbad Desalination Plant[1,4]	50,000	50,000	50,000	50,000	50,000
Water Authority Member Agency Supplies					
Local Surface Water[1,5]	51,580	51,480	51,380	51,280	51,180
Water Recycling[6]	40,459	43,674	45,758	46,118	46,858
Seawater Desalination	6,000	6,000	6,000	6,000	6,000
Potable Reuse	3,300	3,300	3,300	3,300	3,300
Groundwater[1,7]	30,040	31,630	32,670	32,670	32,670
Groundwater	*17,940*	*19,130*	*20,170*	*20,170*	*20,170*
Brackish Groundwater Recovery	*12,100*	*12,500*	*12,500*	*12,500*	*12,500*
Metropolitan Supplies[1]	136,002	181,840	207,413	224,863	248,565
Total Supplies[1,8]	**587,581**	**648,124**	**676,721**	**694,431**	**718,773**
Total Projected Demand with Water Efficiency Savings[1,8]	**587,581**	**648,124**	**676,721**	**694,431**	**718,773**

1 Verifiable expected water supplies for the Water Authority service area, as presented in 2015 Urban Water Management Plan (Water Authority, 2016a). Water budget data for the rural portion of the Region outside the Water Authority service area not available. Values rounded to nearest 10 acre-feet per year.

2 Expected Water Authority supply, per 1997 Water Conservation and Transfer Agreement between the Water Authority and the Imperial Irrigation District for the transfer of conserved agricultural water.

3 Expected Water Authority supply, per Quantification Settlement Agreement on the Colorado River. The supply includes 2,500 acre-feet of environmental water deliveries.

4 Carlsbad Desalination Project at Encina Power Station.

5 Expected average yield of member agency surface reservoirs during normal year hydrologic conditions.

6 Projected recycled water development based on member agency project implementation schedules.

7 Projected groundwater extraction yields by Water Authority member agencies during normal year hydrologic conditions. Includes groundwater recovery through demineralization treatment of brackish groundwaters.

8 Values may not add to exact total due to rounding.

In addition to assessing a normal hydrologic year, the Water Authority's *2015 Urban Water Management Plan* (2016a) also developed supply estimates under single dry and multiple dry water years. Table 3-41 presents the Water Authority's water supply and demand assessment for a single dry water year. The *2015 Urban Water Management Plan* concludes that no shortages are anticipated within the Water Authority's service area under single dry-year through 2035 provided that (1) projected Metropolitan, Water Authority, and member agency supplies are developed as planned, and (2) retail conservation targets are achieved.

The *2015 Urban Water Management Plan* indicates that, in multiple dry water years, the Region is at risk for shortages. The plan also notes that the most reliable method for alleviating shortages during a dry period is to utilize carryover storage (Water Authority, 2016a). The Water Authority also developed a *Water Shortage Contingency Plan* (Water Authority, 2017a) that identifies shortage management actions to minimize the impacts of drought-related imported water shortages and to equitably allocate supplies to member agencies.

Table 3-41: Water Authority Water Supply Portfolio – Single Dry Water Year[1]

Demand Parameter	Projected Water Supply (acre-feet per year)				
	2020	2025	2030	2035	2040
Water Authority Supplies					
IID Water Transfer[1,2]	190,000	200,000	200,000	200,000	200,000
Canal Lining Projects[1,3]	80,200	80,200	80,200	80,200	80,200
Coachella Lining	*24,000*	*24,000*	*24,000*	*24,000*	*24,000*
All American Lining	*56,200*	*56,200*	*56,200*	*56,200*	*56,200*
Carlsbad Desalination Plant[1,4]	50,000	50,000	50,000	50,000	50,000
Water Authority Member Agency Supplies					
Local Surface Water[1,5]	6,004	6,004	6,004	6,004	6,004
Water Recycling[6]	40,459	43,674	45,758	46,118	46,858
Seawater Desalination	6,000	6,000	6,000	6,000	6,000
Potable Reuse	3,300	3,300	3,300	3,300	3,300
Groundwater[1,7]	27,381	27,781	27,781	27,781	27,781
Groundwater	*15,281*	*15,281*	*15,281*	*15,281*	*15,281*
Brackish Groundwater Recovery	*12,100*	*12,500*	*12,500*	*12,500*	*12,500*
Metropolitan Supplies[1]	263,340	264,740	263,340	260,680	258,720
Total Project Supplies without Storage Takes[1,8]	**666,684**	**681,699**	**682,383**	**680,083**	**678,863**
Total Projected Demand with Water Efficiency Savings[1,8]	629,198	694,147	725,006	743,990	770,765
Potential Supply (Shortage) or Surplus	37,486	(12,448)	(42,623)	(63,907)	(91,902)
Utilization of Carryover Supplies	0	12,448	42,623	40,000	40,000
Total Projected Core Supplies with Utilization of Carryover Storage Supplies	**666,684**	**694,147**	**725,006**	**720,083**	**718,863**
Remaining Potential Surplus Supply, or (Shortage) that will be handled through Management Actions	37,486	0	0	(23,907)	(51,902)

1 Verifiable expected water supplies for the Water Authority service area, as presented in *2015 Urban Water* Management Plan (Water Authority, 2016a). Water budget data for the rural portion of the Region outside the Water Authority service area not available. Values rounded to nearest 10 acre-feet per year.

2 Expected Water Authority supply, per 1997 Water Conservation and Transfer Agreement between the Water Authority and the Imperial Irrigation District for the transfer of conserved agricultural water. Expected Water Authority supply, per Quantification Settlement Agreement on the Colorado River. The supply includes 2,500 acre-feet of environmental water deliveries.

3 Proposed Carlsbad Desalination Project at Encina Power Station.

4 Expected average yield of member agency surface reservoirs during single dry year hydrologic conditions.

5 Projected recycled water development based on member agency project implementation schedules.

6 Projected groundwater extraction yields by Water Authority member agencies during single dry year hydrologic conditions. Projected groundwater recovery is through demineralization treatment of brackish groundwaters.

7 Values may not add to exact total due to rounding.

Water demand projections and water supply diversification strategies developed by the Water Authority are acknowledged by DWR in the *California Water Plan Update 2013* (Bulletin No. 160). The *California Water Plan Update 2013* notes the importance of regional water supply planning, and describes water supply diversification strategies of the Water Authority and other Southern California agencies.

Cost of Water Supply Diversification

To meet the Region's water supply diversification goals, additional sources of local supply will need to be developed. However, development of new supplies to diversify the Region's portfolio will likely be more expensive than existing supplies. There are a number of factors that can influence supply development costs, such as, location, size, and configuration of a project. For example, brackish and seawater desalination project unit costs can vary based on the extent of the product water conveyance required, pumping requirements, access to existing infrastructure, and method of brine disposal.

Diversification Project Costs

Project Type	Estimated Unit Cost ($/AF)
Brackish Groundwater Desalination	**$800–$2,000**
Seawater Desalination	**$2,511**
Potable Reuse	**$2,300**

Proposed brackish groundwater desalination projects have an estimated unit cost of $500-$2,000 per acre-foot (OMWD, 2017; Sweetwater Authority, NDA). The purchase and delivery of water from the Carlsbad Desalination Plant in 2018 has a total unit cost of $2,511 per acre-foot.

The City of San Diego's Water Purification Demonstration Project confirmed the feasibility of a full-scale reservoir augmentation project, which is now designed to produce 30 mgd of potable water via reuse by 2021 (refer to *Section 3.5.5* for more information). In July 2012, the City of San Diego completed a *Recycled Water Study* that identified potable reuse opportunities in the Metropolitan Wastewater System service area (see Figure 3-12: Regional Wastewater/Recycled Water Infrastructure for map) and determined that 83 mgd of potable water production via reuse was foreseeable from various treatment sites. The estimated cost to produce potable water via reuse is $1,700-$1,900 per acre-foot. Phase 1 of the City of San Diego's Pure Water Program will expand the existing North City Water Reclamation Plant (NCWRP) and construct the adjacent North City Pure Water Facility to produce 30 mgd of potable water.

The primary drivers influencing wholesale water rates are the costs related to the purchase and treatment of water. Supply costs are tied to the purchase of imported water from Metropolitan and of transfer supplies through the Water Authority's transfer agreement with IID. As the cost of imported water increases, local supply options become more cost-competitive and cost-effective in comparison. Despite higher water rates that may be associated with water supply diversification, these efforts have largely received support from local residents and water rate payers, and such support has been documented in a number of public opinion polls. A 2017 public opinion poll conducted by the Water Authority indicated that the vast majority of respondents (79%) support the Water Authority's diversification plan (Water Authority, 2017b). The 2017 Water Authority poll showed that 41% of residents felt that rate increases are necessary to maintain water supply reliability. Of the respondents open to paying a surcharge for development of additional drought-resilient water supplies (76%), the mean willingness to pay for such development was $7.78 per month. In addition, 61% of respondents were in support of mixing advanced treated recycled water into the existing supply of drinking water.

3.11 Major Water Related Issues and Conflicts

As documented in this section, significant interrelationships exist among the Region's key water resources needs and IRWM Plan goals of enhancing water supply, enhancing recreation, and providing environmental stewardship. Table 3-342 summarizes key water management issues within the Region and potential conflicts that may occur in resolving the issues.

Table 3-42: Summary of Water Management Issues and Potential Conflicts

Water Management Issue	Potential Conflicts
Flood Control	• Difficulty in permitting invasive species removal and limitations on geographical or seasonal access to channel(s) • Potential conflicts with environmental protection or enhancement goals • Inconsistent or unreliable funding sources for flood control projects • Zoning or land use restrictions for protection of flood prone areas, including effectiveness of land use controls as well as implementing restrictions in areas that have already been developed and may be "grandfathered" in under older regulations
Stormwater	• Diverting noncompliant stormwater to groundwater recharge may conflict with groundwater protection goals • Diverting noncompliant stormwater to habitat improvement areas may conflict with surface water protection goals • Proposed stormwater BMPs may conflict with local land use regulation • Stormwater capture/use may reduce flows available to downstream beneficial uses • Managing the economic feasibility of stormwater capture and use • Securing funding or allocating existing funding to address stormwater needs while minimizing potential impacts to other areas of responsibility related to shifts in funding
Water Supply	• Local supplies (developed for reliability purposes) are limited or more costly than imported supplies • Imported water may not comply with Basin Plan water quality objectives • Basin Plan objectives may conflict with indirect potable reuse operations • Groundwater production or recharge may conflict with environmental protection needs of groundwater-dependent vegetation • Managing water supply cost increases • Increased water reuse (recycled and potable) may conflict with environmental and other downstream needs
Water Quality Standards	• The need to meet water quality concentration limits may result in reduced discharges or flows required to support downstream beneficial uses • 303(d) listing/TMDL process may prevent implementation of projects that improve water quality but do not result in attainment of water quality goals • Existing standards may not be representative of actual beneficial use protection needs • Current "one-size-fits-all" Basin Plan objectives do not take into account seasonal or flow influences • Assigning costs to water quality improvements (source identification) in regional reservoirs to augment surface water supply storage

Water Management Issue	Potential Conflicts
Institutional Issues	• Potential conflicts may occur between land use regulations and water quality protection needs • Available San Diego Water Board staffing levels may be inconsistent with staffing needs required to address priority Basin Plan modifications • Inter-border jurisdictional issues may hamper actions to achieve water quality objectives • Political conflicts outside of resource management agencies' control may result in impacts to natural resources • Water rights may limit development of certain groundwater basins and may conflict with use of return flows from imported water irrigation
Salinity/Brine Management	• Water conservation measures may lead to increased wastewater salinity • Brine discharges to sewer may conflict with water reuse (recycled and potable) needs • Brine discharges to ocean may conflict with environmental protection needs
Recreation	• Body contact and non-contact recreation may impact the water quality standards implemented to support such recreational uses • Sediment controls in watercourses may impact sand availability at downstream beaches
Climate Change	• Climate change may affect water supply availability because of droughts, seawater intrusion, changes in precipitation volumes and timing, altered fire and weather regimes, and potential changes in the availability of imported water supplies • Beneficial uses may be impacted by climate change or water quality standards more difficult to meet or no longer appropriate • Uncertainty related to climate change impacts make responses and mitigation efforts difficult to plan (low political support) • Sea level rise may compromise the integrity of coastal water resource infrastructure
Wastewater	• Cost drivers associated with wastewater systems, including treatment plant upgrades, ongoing treatment and operations, and infrastructure maintenance • Regulatory pressure associated with wastewater operations, including upgrading regional facilities such as the Point Loma Wastewater Treatment Plant • Potential conflict over ownership of wastewater as recycled and advanced treated water increase in value and use • Potential wastewater system operational impacts of measures to reduce water use and alteration of what's discharged to the system
DAC Water Systems	• Lack of municipal water and wastewater service in many rural DACs • Managing aging water and wastewater infrastructure and costs, including O&M • Lack of TMF (technical, managerial, financial) capacity of DAC water system operators

3.12 Neighboring and/or Overlapping IRWM Efforts

The San Diego IRWM is one of three IRWM efforts within the San Diego Water Board (Region 9) jurisdiction, which is designated by DWR as the San Diego Funding Area for the IRWM Program. The other two IRWM regions in the San Diego Funding Area are the South Orange County IRWM and the Upper Santa Margarita River IRWM. The South Orange County IRWM effort is led by an RWMG that is comprised of the County of Orange, Municipal Water District of Orange County, and South Orange County Wastewater Authority. The Upper Santa Margarita IRWM effort is led by an RWMG comprised of the Rancho California Water District, County of Riverside, and Riverside County Flood Control and Conservation District.

RWMG agencies from the three San Diego Funding Area IRWM groups have formed the Tri-County Funding Area Coordinating Committee (Tri-County FACC) through a Memorandum of Understanding (MOU) and have been meeting regularly since 2008. The Tri-County FACC facilitates integration of projects and policies across the San Diego Funding Area where appropriate and helps provide balance to the individual interests of the three IRWM Regions.

The Tri-County FACC governance structure also enables integrated management of watersheds and resources that cross jurisdictions, and specifically aims to coordinate work in the San Juan Watershed and the Santa Margarita River Watershed, both of which lie within at least two of the three IRWM regions (see Figure 3-23). As part of the MOU, the Tri-County FACC RWMGs have committed to coordinated planning and identification of opportunities to support common projects and goals. One example of this effort is a joint project between the Upper Santa Margarita River IRWM Region and the San Diego IRWM Region that seeks to provide better understanding of nutrient impacts in the Santa Margarita River Watershed, and to help determine appropriate levels of nutrients to protect beneficial uses. This project received Proposition 84, Round 1, and Round 2 funding from both planning regions.

The Tri-County FACC has entered into an agreement to share the IRWM funds allocated by DWR to the San Diego Funding Area. This agreement has facilitated coordination between RWMGs by reducing competition and conflicts over funding. The Tri-County FACC agreement is described below, and manages three different aspects: information sharing, shared infrastructure, and competing interests.

Information Sharing

The RWMGs have agreed to share data and information to inform efforts within the Funding Area and inter-regionally. This information sharing helps to facilitate collaboration and address interregional needs. Some of the organizations that help in this data sharing effort include the San Diego Water Board and the Stormwater Monitoring Coalition (SMC).

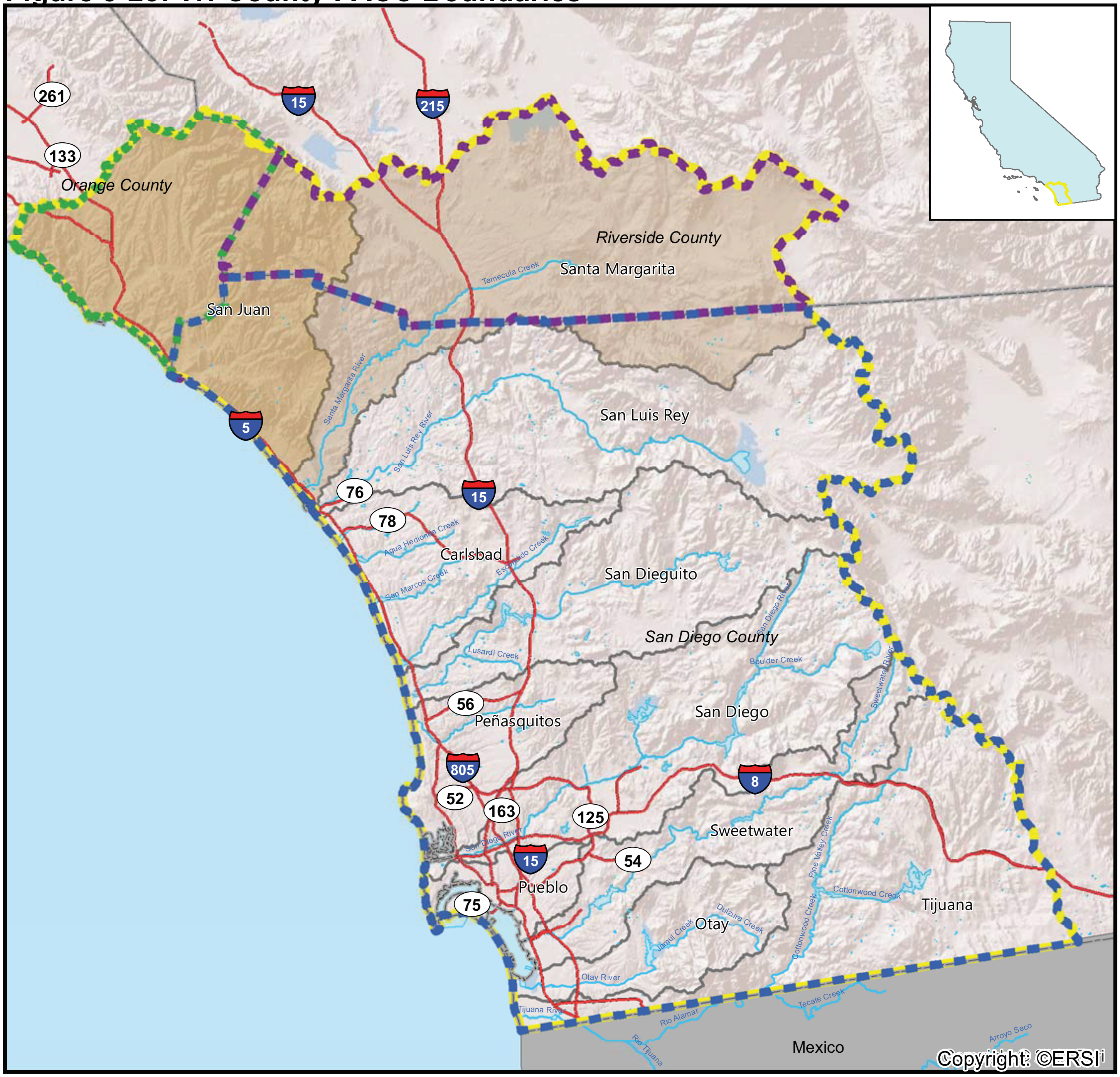
Each of the IRWM Plans in the San Diego Funding Area includes sections on data management and project selection. The Tri-County FACC acts as an advisory council to assist in the development of these sections, particularly in projects or programs that may cross IRWM Region boundaries, which may be funded, administered, or implemented by multiple Regions. Additionally, projects of importance to the watersheds that exist in multiple IRWM Regions are identified for coordination and prioritization in each of the relevant regions' project selection process.

The SMC is comprised of all Phase I municipal stormwater NPDES Principal Permittees and NPDES regulatory agencies in Southern California. This coalition includes Tri-County FACC RWMG members from the County of Orange, Riverside County Flood Control and Water Conservation District, and County of San Diego. SMC members have pooled resources to address data gaps, develop technical information and tools, and improve monitoring effectiveness.

Tri-County FACC members also participate in the San Diego Water Board's stakeholder groups for the development of TMDLs during the TMDL Basin Plan amendment process. Members of the Upper Santa Margarita RWMG and the South Orange County RWMG are also non-voting RAC meetings, in order to stay better informed of the priorities and needs of the San Diego IRWM Region and provide feedback through the public participation process.

The Tri-County FACC worked collaboratively in 2018 to complete the funding area-wide Water Needs Assessment. The three IRWM Regions identified DACs, EDAs, and URCs, and coordinated workshops and outreach presentations to gather feedback to better address primary DAC water resource needs across the three regions.

Figure 3-23: Tri-County FACC Boundaries



Legend
- South Orange County Region
- Upper Santa Margarita Region
- San Juan Overlay
- Santa Margarita Overlay
- San Diego IRWM Region
- Funding Area and Tri-County FACC Boundary
- Waterbody
- Watershed
- County
- Mexico
- River
- Freeway

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Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
L:\Projects GIS\0188-003 SDIRWM Plan Update\MXD\Set 060713\Fig3-18_TriCountyFACCBdy.mxd

Shared Infrastructure

Each of the IRWM Regions in the Tri-County FACC is dependent on imported water, supplied through Metropolitan. As such, they share much of the same water infrastructure. Shared imported water infrastructure includes the Colorado River Aqueduct, Diamond Valley Lake, Lake Skinner, and other major pipelines, all of which are owned and operated by Metropolitan. The Lake Skinner Water Treatment Plant, also owned by Metropolitan, serves over 4 million people in the Tri-County FACC area. In addition to Metropolitan-owned imported water infrastructure, members of the Tri-County FACC also share pipelines used to supply parts of Camp Pendleton. This use of shared infrastructure helps provide common interests between the members of the Tri-County FACC, promoting collaboration between the RWMGs.

Competing Interests

Entities in the three Tri-County FACC regions have occasionally found themselves in conflict over water supply issues in the watersheds in overlay areas. However, various agreements and legal settlements have led to a cooperative management of water allocations between these entities. Currently, there is significant agreement on water allocations, and the Tri-County FACC is supporting collaborative efforts to improve the storage and management of water resources. Recently, some long-standing conflicts have been resolved, and cooperative projects funded. The Tri-County FACC MOU also establishes how IRWM Proposition grant funds will be allocated to each of the IRWM Regions in the Funding Area, making grant applications non-competitive between Regions within the San Diego Funding Area, and improving relations between RWMGs by reducing funding-related conflict. Successful funding agreements have been achieved for each implementation round of Proposition 84 funding, and for the DAC Involvement funding round of Proposition 1. The Tri-County FACC MOU shows the willingness of these agencies to work collaboratively to solve important water resource conflicts, furthering the integration of water resource management.

3.13 United States–Mexico Border Coordination

In addition to neighboring IRWM regions located to the north, the San Diego IRWM Region is bounded to the south by the country of Mexico. Due to this proximity, the Region shares several water resource planning and coordination efforts with Mexico.

With specific regards to water supply resources, the South Bay International Wastewater Treatment Plant, located in San Ysidro, was built to address issues associated with wastewater treatment needs in Mexico that had resulted in contamination of portions of the Tijuana River located in the United States (International Boundary and Water Commission, ND). In addition, the Otay Water District located in the Region has an emergency connection with Mexico to provide water supplies to the city of Tijuana in an emergency situation.

With respect to water quality, efforts have been under way to address pollution issues in the Tijuana River Valley Floodplain through the Tijuana River Valley Recovery Team (Recovery Team). The Recovery Team is organized through the San Diego Regional Water Quality Control Board, and has the goal of partnering with Mexico to implement watershed-based solutions to address issues that affect United States and Mexico portions of the Tijuana Watershed (San Diego Water Board, 2013b).

Coordination with Mexico on water-related issues continues to grow in the Region, and in 2012 the U.S. Environmental Protection Agency and the Secretary for the Environment and Natural Resources of Mexico signed the Border 2020 agreement, which aims to address environmental issues such as water quality (EPA, 2013). Further, the Otay Water District recognizes that Mexico may be a potential future customer for recycled water supplies, and is exploring opportunities to work bi-nationally on water supply projects.

The California Department of Parks and Recreation was recently awarded IRWM funding under Prop 1 to provide planning and environmental review for the restoration of the abandoned Nelson Sloan Quarry located in the Tijuana River Valley. The project will beneficially re-use sediment from the Goat Canyon Sediment Basin and other flood channels to fill the quarry and restore the area to its native habitat.

As stated in the *Tijuana River Valley Recovery Strategy (TRVRS)*, efforts to protect and restore Tijuana River Valley resources are not new; sediment management, land preservation and habitat restoration have been conducted in the Tijuana Watershed for many years. Local, state, and federal management agencies, along with non-governmental organizations and other stakeholders have invested substantial effort and funding in project planning and implementation both in the United States and in Mexico to improve conditions. Investments to improve wastewater treatment began in the 1980s and 1990s. Recent activities have included pollution prevention and source control for sediment and trash, water quality improvements, flood control, improved recreational opportunities, and public education and outreach. These projects demonstrate the dedication and wealth of experience that the various operating agencies and stakeholders have invested in the Valley and watershed (TRVRS, 2012).

The future brings many challenges for the Tijuana River Valley Recovery Team. The bi-national nature of the watershed is one major hurdle. It is well known that source control and pollution prevention activities can be the most cost-effective solutions to reduce sediment and trash loading. With the majority of the watershed situated in Mexico, planning and implementing source control and other projects across the international border present an added challenge to an already complex issue.

Despite existing and future planned efforts to coordinate with Mexico on water management and watershed-based solutions, the limited decision-making authority of bi-national agencies results in long processes and implementation challenges. The IRWM Program will continue to work with existing organizations in the Region to address cross-border issues and implement integrated water management solutions, as appropriate.

3.14 Climate Change

Global climate change is predicted to have significant impacts on the hydrologic conditions in the Region, within California, and in the Colorado River Basin. The three primary climate stressors that will impact the San Diego region are: 1) temperature increases, 2) precipitation regime changes, and 3) sea level rise; which together will have far reaching implications for water supply, water quality, hydrology, and infrastructure. Notably, climate impacts to other parts of California and to the Colorado River Basin will also affect the availability of imported water. A general hydrological implication is that climate change will give rise to more extreme future scenarios (i.e., drought and storm events) on more variable timelines, which confirms a need for resilience planning focused on holistic adaptation efforts. All climate models and the severity of their implications are dependent on greenhouse gas emissions and the extent to which mitigation is effective, making climate mitigation an equally important component of climate resilience.

DWR coordinated a literature search on global climate change issues and summarized probable impacts within the *California Water Plan Update 2013* (DWR, 2013) and within *Progress on Incorporating Climate Change into Management of California's Water Resources* (DWR, 2006). As part of the California Fourth Climate Change Assessment, The Scripps Institution of Oceanography also coordinated the San Diego Region Report which includes an assessment of regional water and infrastructure vulnerabilities to climate change as well as emerging adaptation solutions (Kalansky, et al, 2018). For that same assessment, the Climate Science Alliance produced the technical report "San Diego County Ecosystems: The Ecological Impacts of Climate Change on a Biodiversity Hotspot" which focuses on specific ecosystems impacts of climate change (Jennings et al., 2018). In addition, the Ocean Protection Council released the latest guidance for sea level rise planning, *State of California Sea-Level Rise Guidance: 2018 Update* (Resources Agency, 2018).

Key impacts documented and forecasted within these reports are summarized below:

- *Temperature.* By the end of the 21st century, scientists predict the annual average temperatures in the San Diego region will increase by 5-10 °F (Kalansky et al. 2018). Hot temperature extremes or 'heat waves' are expected to increase in their frequency, duration and intensity[2]. Shifts in temperature patterns may also adjust the timing and duration of seasons, such that the timing of spring may occur earlier and onset of winter may be delayed. Extreme temperatures may exceed physiological thresholds for temperature tolerance for some species. Importantly, climate warming is projected to take a toll on the region's current water supply sources. Estimated reductions of Colorado River flow range from 10-45% by mid-century (Udall and Overpeck, 2017). Supplies to the State Water Project are expected to reduce by 10% or more by 2050 and San Diego County's native surface water will be impacted by increased temperatures as well as by precipitation variability in particular, which affects seasonal availability (Wang et al. 2018, Kalansky et al. 2018). Meanwhile, warmer temperatures may result in a higher demand in energy for cooling, and greater water demand by agriculture. Higher air temperatures will not only lead to greater evaporation of reservoirs and lakes, but also to earlier and potentially stronger thermal stratification of reservoirs. Increased air temperatures will also translate into higher water temperatures for freshwater streams and estuaries, which may have adverse effects for biological communities. These impacts may adversely affect cold water or other species, as well as increase the frequency and intensity of algae blooms and other water-borne agents. Additionally, warmer temperatures may result in a, higher demand in energy for cooling, and greater water demand by agriculture.
- *Hydrologic Patterns.* Precipitation will remain highly variable but will change in character; with wetter winters, drier springs, and more frequent and severe droughts punctuated by more intense individual precipitation events (Kalansky et al. 2018). Overall, climate models indicate that that by 2050 the region will become much drier due to an increase in the number of dry days and the dry years becoming drier, with a marked decrease of precipitation in the shoulder seasons of autumn and spring (Kalansky et al. 2018). More dry years also leads to an increase in the duration, frequency, and severity of droughts in the future. Higher temperatures will exacerbate future droughts leading to larger water deficits across the landscape and have other wide-reaching impacts to fire frequency, reservoir operations, water quality, and ecosystem (Kalansky et al., 2018). Recently (2012-2016), the state experienced a historic drought and mandatory use restrictions were enacted statewide. The extremely warm dry years of 2014 and 2015 are a harbinger of future droughts given the high temperatures during these drought years. (Dienbaugh et al., 2015). While days with measurable precipitation are projected to become less frequent in Southern California, extreme precipitation events will intensify (see *Storm Intensity*). By the end of the century, the average wettest day every five years is projected to increase by 10-25% under a moderate emissions pathway and by 15-30% under a business-as-usual emissions

[2] The number of heat wave days is projected to increase between 20-50% under a 6 ̊F temperature increase

scenario (Kalansky et al 2018). Abrupt transitions from extreme dry scenarios to extreme wet scenarios is characterized as "precipitation whiplash" and can have implications to hydrology and water management. For instance; long periods of drought can lower soil moisture conditions, inducing erosion and making flooding potentially more destructive. Climate change may also result in a shift in storm tracks. Existing data (DWR, 2006) show a trend of increasing precipitation in Northern California and decreasing precipitation in Southern California during the past century. For example, typically El Niño events bring higher precipitation to Southern California. However, during the 2015-2016 El Niño, a mass of anomalously warm water off the Pacific Northwest (a.k.a. the blob) facilitated the formation of a resilient atmospheric ridge, which blocked much of the expected precipitation to Southern California. As sea surface temperatures change, it remains unclear how the precipitation patterns typically expected by the El Niño Southern Oscillation may change.

- *Storm Intensity.* Climate change projections suggest that rain events will become more extreme, bringing larger and more intense storms to the region (see *Hydrologic Patterns*). These changes have implications for flood management, erosion, and water quality in surface reservoirs and freshwater, estuarine, and marine water bodies, including ephemeral streams and urbanized creeks. In addition, the risk of mudslides and debris flows increase, particularly following wildfires predicted to become more frequent and intense due to climate change. Increases in storm intensity may have negative environmental impacts as well as negative impacts to human health and safety. Particular infrastructure challenges related to intense storms include: Flood control challenges, where current flood control issues like debris build-up in basins are further intensified; wastewater infrastructure vulnerabilities; where large sewage spills in the region are already associated with large storm events impacting wastewater treatment centers; and other exposed infrastructure vulnerabilities — including the miles of sewage pipelines and treatment facilities located in canyons that will face increased risk from flooding or erosion (Kalansky et al. 2018).
- *Sea Level Rise.* In San Diego, sea level rise is projected to rise approximately 1 foot by 2050 and 3 feet or potentially much higher by 2100 (Kalansky et al. 2018.). There is a 1 in 20 chance that sea level could rise as much as 4.6 feet by 2100 (Resources Agencies, 2018). Higher mean sea level, in combination with high tide and storm events, may increase coastal erosion, impacting ecosystems and tidal wetlands. These combined forces may also lead to inundation of coastal wastewater infrastructure and storm drain systems, impacting the effectiveness of these systems to discharge to the ocean. Storm water pipes can become submerged under high sea level events, as was shown during the 2011 king-tide event (San Diego Union Tribune, 2011), potentially causing flooding issue upstream. Using the USGS Coastal Storm Model System (CoSMoS) maps, San Diego Region Report authors for the California Fourth Climate Change Assessment found that some pump stations are relatively more vulnerable, with one pump station in Otay Mesa being affected by a 20-year flood with 1.6 feet of sea level rise. (Kalansky et al, 2018). In addition, as sea level rises, there is an increased probability that salinity will intrude into the Sacramento Bay Delta, adversely impacting the quality of SWP supplies delivered to the Region. Similarly, groundwater basins in coastal areas may become more brackish in nature, potentially increasing the costs of utilizing groundwater resources for drinking water or other purposes. The ecological impacts of sea level rise include coastal erosion and the loss of coastal wetlands, which provide numerous ecosystem services including nutrient cycling, carbon storage, and biodiversity. Additionally, much of the coastline is populated by businesses, military and other government facilities, parks, and homes, which makes these structures at risk of inundation, subsidence, or erosion impacts.

- *Wildfire.* The frequency and severity of wildfires in the San Diego region have increased over the 20th Century. The reduced time intervals between fires may be too short for native vegetation to recover, resulting in the conversion of native shrub land to weedy annual grasses. These changes could dramatically reduce the region's biodiversity. More frequent, longer, or more intense drought could also lead to larger and more frequent fires, as drought increases dead and dry fuels available to burn. Similarly, climate change may also result in warmer Santa Ana winds, increasing their ability to dry out fuels. With predicted changes in precipitation, vegetation may exhibit reduced moisture content for longer periods of time, lengthening the fire season into the winter and even spring. As the climate changes, weather patterns are predicted to be more variable. For example, the fall of 2017 experienced extremely warm, dry, and in some parts of the state, fiery conditions, followed by an extreme rain event. As a result, severe erosion and mudslides occurred, washing the recently burned material downstream. While San Diego did not experience mudslides in 2017, the conditions that led to mudslides elsewhere in the state are present in the San Diego region, and associated risk expected to increase due to the effects of climate change. These events exemplify the type of conditions expected to occur more frequently in the future and may have significant impacts on watersheds, water quality, and communities in flood-prone and fire-prone areas.
- *Water Demand.* Potential global warming effects on vegetation evapotranspiration are currently unknown; however, irrigation demands could potentially increase. While increased temperature results in increased evapotranspiration, this may be partially offset by the fact that increased atmospheric carbon dioxide can result in reduced vegetation water consumption. Warmer and drier climactic trends are likely to result in increased water demands region-wide to support outdoor irrigation, similar to the summer demand peaks seen today. More water may also be needed for cooling in various sectors throughout the region due to higher temperatures.
- *Snowpack Changes.* While snowpack represents a negligible component of the water balance within the Region's local water supplies, snowpack in the Sierra Nevada Mountains represents California's largest water storage component. The Sierra Nevada snowpack is projected to decline by at least 25% by the year 2050 (DWR 2007), thereby reducing freshwater flows and the volume of water available for transport. Increasing winter and early spring temperatures will cause earlier melting of the Sierra Nevada snowpack and may also shift the type of precipitation from snow to rain. More snow falling as rain is likely to cause greater flows in the winter, when flooding is already a problem, and fewer flows in the summer when flows are low. These impacts may pose challenges for water storage, as a shift from snow to rainfall will require more storage to be available to capture rain (Resources Agency, 2009). Capturing rainfall will be particularly challenging during El Niño, when precipitation is generally higher. Shifts in precipitation patterns may also require additional flood control measures to account for higher rainfall and reduced snowpack.
- *Energy Demand.* Climate change may also result in increased energy demands that will require increased conservation and efficiency measures. 2035 projections show an increase in normal water demand by 20% from the average demand that occurred over the period of 2005-2010 (City of San Diego, 2015). In addition, California's hydroelectric power generation may be less reliable. Further, should the Region's demands for imported water increase due to a reduction in local supply reliability associated with the effects of climate change, energy will be required to pump the additional imported water to the Region.

In addition to the impacts listed above, recent events at Oroville Dam during the 2016/17 El Niño highlighted the direct impacts of extreme precipitation events on water infrastructure and flood risk. The heavy rainfall in Northern California that year led to a need for Oroville Dam to release water through its spillway, which was damaged in the process, requiring the use of the emergency spillway, which also experienced damage. Downstream communities were evacuated, flows in the Feather River rose substantially and quickly, the emergency spillway experienced substantial erosion, and tons of sediment was released downstream. DWR's Division of Safety of Dams (DOSD) established the Spillway Re-evaluation Program to assess dam structures and confirm they meet minimum safety standards. This Program, in addition to the regular DOSD dam evaluations, resulted in additional restrictions on dam operations, including limitations on water surface levels. As climate change impacts are anticipated to affect precipitation patterns and snowmelt timing, reservoir managers may need to maintain lower reservoir elevations in preparation for larger inundations when water does enter the reservoir. This may lead to more frequent dam releases or larger dam releases, which represent a missed opportunity for local water supply.

In the near term, the water resources and ecosystems in the region will be most threatened by landscape changes, habitat disturbance (loss, pollution, etc.), and fragmentation due to development and fire. In the long-term, climate variability will compound those stressors with increased temperatures, precipitation variability, occasional higher intensity flooding, more frequent and prolonged drought, and more destructive fires. Efforts to respond to climate change vulnerabilities within the Region are currently being developed. The 2017 SWRP and 2018 SWCFS investigates the potential benefits of stormwater capture and use projects. Stormwater capture projects can be designed to enhance wetlands or riparian habitat. Healthy wetlands provide flood protection and mitigation to sea level rise, and act as carbon sinks. In addition, developing such a local supply can help to reduce the demand for imported water, thus reducing both the amount energy needed to transport water and the resultant GHG emissions.

DWR has also identified needs for further assessment of how global climate change may affect California water planning and management. The California Natural Resources Agency has outlined strategies to plan for and adapt to climate change. The *Safeguarding California Plan: 2018 Update* is the State's roadmap for everything state agencies are doing and will do to protect communities, infrastructure, services, and the natural environment from climate change impacts. This holistic strategy primarily covers State agencies' programmatic and policy responses across different policy areas, but it also discusses the ongoing related work to with coordinated local and regional adaptation action and developments in climate impact science. Regardless of the projected altered conditions, improving local stewardship of the Region's water resources will improve the Region's ability to withstand impacts from natural variability and changes in climate conditions.

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