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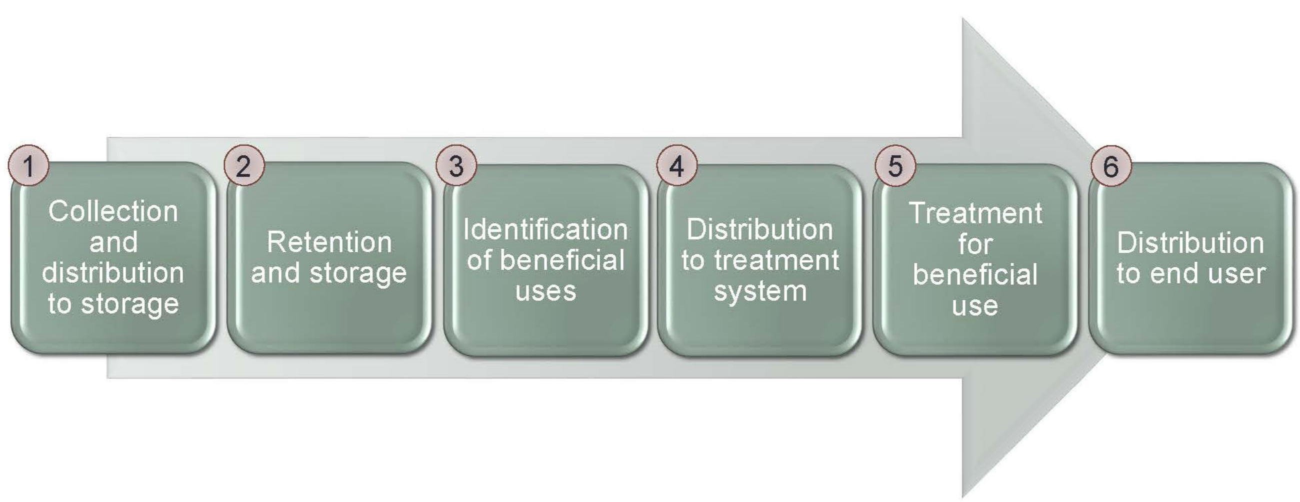
memorandum

date	August 30, 2017
to	Stephanie Gaines, County of San Diego
cc	
from	Lindsey Sheehan, PE, Alex Trahan, PE, David Pohl, PhD, PE, ESA
subject	San Diego Stormwater Capture Feasibility Study - Framework and Data (FINAL)

The San Diego Stormwater Capture Feasibility Study (SCFS) is designed to provide a County-wide analysis to determine the feasibility of planning, constructing, operating, and managing facilities that capture and use stormwater beneficially. This memo documents the first steps in the assessment: development of the analysis framework and data collection.

The SCFS will be conducted based on a framework that considers each step of the stormwater capture and beneficial use process. **Figure 1** presents the conceptual model, which starts with stormwater collection and distribution to a retention or storage site/facility. Because stormwater is generally delivered in large volumes during a short time frame, stormwater collection and storage is needed prior to distribution to a beneficial use. This is emphasized in urbanized areas, where, due to larger areas of impervious surfaces, large stormwater runoff volumes are generated and are often quickly directed to storm drain systems to address potential flooding and public safety concerns. To be put to beneficial use, the collected urban runoff volume needs to be stored temporarily to address flow and water quality requirements. As shown in Figure 1, flow and water quality through controlled release and treatment, respectively, must be managed prior to or in the process of distribution to the end user, depending on the identified beneficial use. In developing a list of data needs and gaps, the Project Team used this conceptual model of the stormwater capture and beneficial use process to identify the types of data needed to analyze the feasibility of stormwater capture and beneficial use.

Figure 1 Stormwater Capture and Beneficial Use Conceptual Model



The following beneficial uses have been identified for evaluation as part of this study:

A. Direct discharge to designated groundwater aquifers to be extracted for potable use

B. Discharge to groundwater to reestablish natural hydrology and, by extension, to restore biological beneficial uses

C. Irrigation to be used on site or at nearby parks, golf courses, or recreational areas on public parcels

D. Small scale on-site use for irrigation and other private use on private parcels

E. Flow-through to sustain vegetation in natural treatment system (wetland treatment) and/or restoration sites

F. Controlled discharge to waste water treatment plants for solids management during low flows

G. Controlled discharge to waste water treatment plants for indirect potable use

H. Controlled discharge to waste water treatment plants for recycled water use

Attachment A presents the data needs and gaps to evaluate the feasibility of stormwater capture and beneficial use. The first step in the feasibility analysis was to collect and evaluate existing data and identify gaps in the data.

At the beginning of the study, a list of data needs was identified based on the conceptual model and potential beneficial uses. Working closely with the County, the Project Team used this data needs list to conduct an initial search of available sources, reports, data, and information. The updated data needs list (which was revised based on the initial research) was then presented to the project's Technical Advisory Committee (TAC) at the first TAC meeting on July 18, 2017. Based on feedback from the TAC, Attachment A was expanded from the list of data needs to a more detailed and refined data request, including:

1) Data Files/Plans/Reports Needed
2) Scale of Data Request
3) Additional Details/Notes

These additional clarifications on the data needs request were distributed to the TAC on July 24, 2017, with a request for data by August 8, 2017.

The Project Team then compiled the data and reports provided by the TAC and further expanded the data needs list to include 4) List of Sources Obtained. Attachment A provides an updated summary of the data needs, data and information received and reviewed, and remaining data gaps. Finally, Attachment A provides steps forward for each of the data needs in the final column. The steps forward include additional research in the area, which will continue into Task 2, or development of assumptions that will be used as the basis for the feasibility analysis using the available data to the extent applicable. Attachment A, therefore, provides a status summary of the data gathering and a road map for the next steps forward.

This memo documents the available existing conditions data (Section 1). The regulatory framework for stormwater capture and beneficial reuse in the San Diego region is presented in Section 2. Section 3 provides a summary of existing plans and studies on this topic.

1. Existing Conditions Data for Stormwater Capture and Beneficial Use in San Diego County

The data collection process involved an initial review of available data, outreach and data request to the Technical Advisory Committee (TAC), then further collation of data based on responses from the TAC. Attachment A presents a table of data needed for the SCFS study and either a source that provides that data or assumptions that will be used to fill the data gap. The available data and how they will be used in the study are discussed further in the following sections.

1.1 Watershed Identification

The San Diego region is composed of ten watershed management areas (WMAs), as defined by the Municipal Stormwater Permit (NDPES Permit Number R9-2013-0001 as amended by R9-2015-0100) (**Figure 2**). These WMAs drain westward from the Tecate Divide to the Pacific Ocean. **Table 1** shows the hydrologic units (HUs) and hydrologic areas (HAs) that comprise each WMA.

TABLE 1
WATERSHED MANAGEMENT AREAS WITHIN SAN DIEGO COUNTY

Watershed Management Area	Hydrologic Unit(s)	Hydrologic Areas
San Juan	San Juan (901.00)	San Mateo Canyon (901.4) San Onofre (901.5)
Santa Margarita River	Santa Margarita (902.00)	Ysidora (902.10) De Luz (902.20) Pechanga (902.50) Aguanga (902.80) Oakgrove (902.90)
San Luis Rey River	San Luis Rey (903.00)	Lower San Luis Rey (903.10) Monserate (903.20) Warner Valley (903.30)
Carlsbad	Carlsbad (904.00)	Loma Alta (904.10) Buena Vista Creek (904.20) Agua Hedionda (904.30) Encinas (904.40) San Marcos (904.50) Escondido Creek (904.60)
San Dieguito River	San Dieguito (905.00)	Solana Beach (905.10) Hodges (905.20) San Pasqual (905.30) Santa Maria Valley (905.40) Santa Ysabel (905.50)
Los Peñasquitos	Peñasquitos (906.00)	Miramar Reservoir (906.10) Poway (906.20) Scripps (906.30)

Mission Bay	Peñasquitos (906.00)	Miramar (906.40) Tecolote (906.50) Vacation Isle (906.60) Fiesta Island (906.70) Mission Bay (906.80)
San Diego River	San Diego (907.00)	Lower San Diego (907.10) San Vicente (907.20) El Capitan (907.30) Boulder Creek (907.40)
San Diego Bay	Pueblo San Diego (908.00)	Point Loma (908.10) San Diego Mesa (908.20) National City (908.30)
	Sweetwater (909.00)	Lower Sweetwater (909.10) Middle Sweetwater (909.20) Upper Sweetwater (909.30)
	Otay (910.00)	Coronado (910.10) Otay (910.20) Dulzura (910.30)
Tijuana River	Tijuana (911.00)	Tijuana Valley (911.10) Potrero (911.20) Barrett Lake (911.30) Monument (911.40) Morena (911.50) Cottonwood (911.60) Cameron (911.70) Campo (911.80)

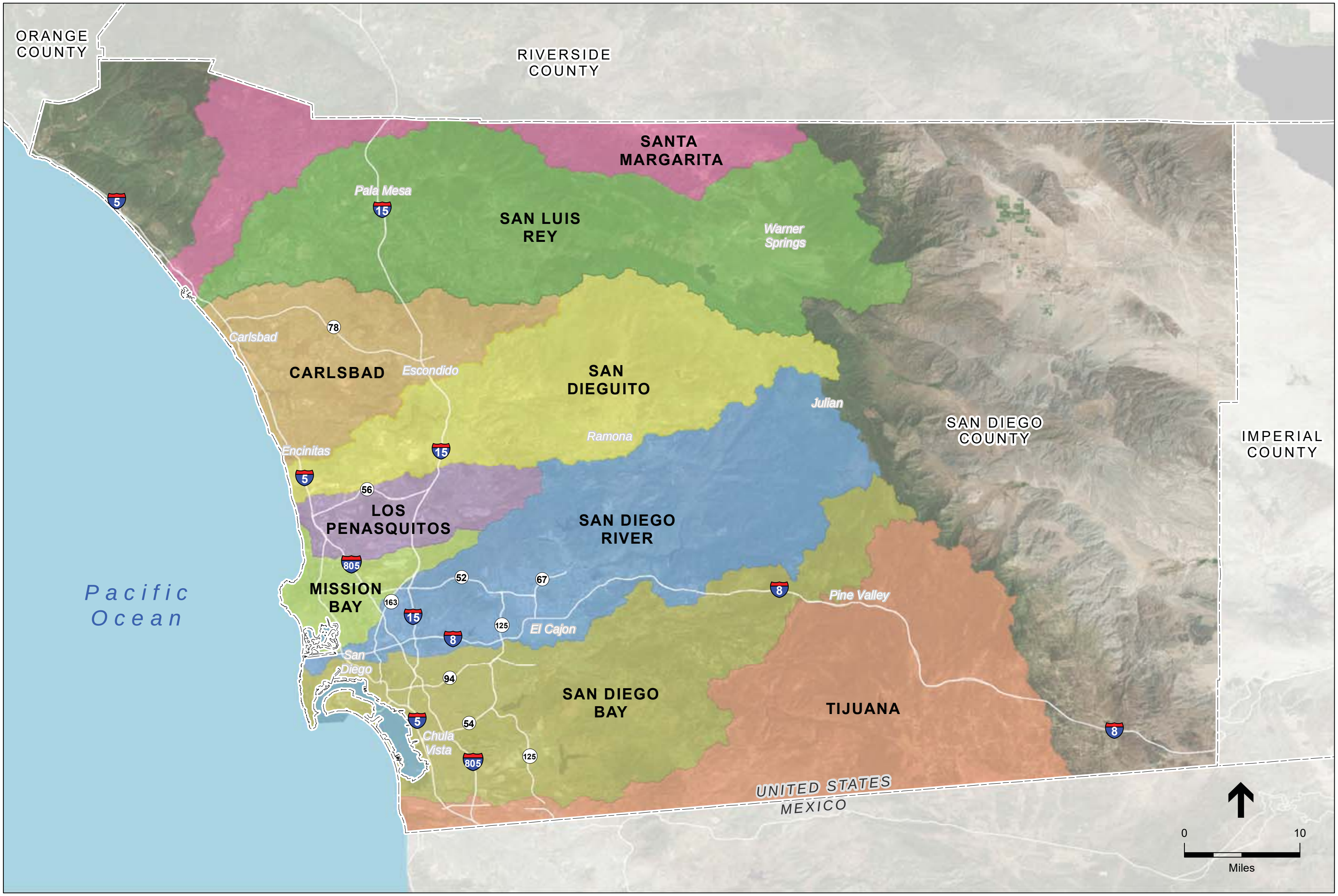
The WMAs are management units for stormwater. Projects identified as part of the SCFS will be prioritized by WMA when making water management plans and decisions.

1.2 Climate

The San Diego region is large enough to cover several climatic regions, ranging from the semi-arid Mediterranean coast, through the mountainous center, to the hot, arid desert in the east. Annual average temperature highs vary significantly across the region, from 70℉ at the coast to 89.5℉ inland. Annual average precipitation also varies significantly across the region, from 10.1 inches at the coast to 28.0 inches in the mountains, to 3.7 inches in the desert. Rain gauge data is available online from then National Oceanic and Atmospheric Administration (NOAA) at 174 locations across the region. Snowfall is negligible on the coast and in the desert, but an average of 22 inches falls in the mountains. This is summarized in **Table 2**.

TABLE 2
TEMPERATURE AND PRECIPITATION AVERAGES ACROSS SAN DIEGO COUNTY

	Coastal - Lindbergh Field			Mountain - Julian			Desert - Ocotillo Wells		
	Annual	**Summer**	**Winter**	**Annual**	**Summer**	**Winter**	**Annual**	**Summer**	**Winter**
Average Max. Temperature (°F)	69.9	74.0	65.3	68.6	84.1	53.7	88.1	106.1	69.5
Average Min. Temperature (°F)	56.5	63.6	48.8	45.4	57.3	36.0	64.6	80.9	48.6
Average Total Precipitation (inch)	10.1	0.1	5.8	28.0	1.5	14.8	3.7	1.0	2.1
Average Total Snow fall (inch)	0.0	0.0	0.0	22.0	0.0	11.5	0.0	0.0	0.0



SOURCE: ESRI, 2016; SanGIS, 2016

SWRP . 160618

Figure 2

San Diego County Watershed Management Areas

Rainfall volumes and evapotranspiration rates are important in determining the required size of stormwater infrastructure and irrigation needs for some beneficial use options. The 85th percentile storm isopluvals for the county (from SanGIS) provide further resolution to stormwater load estimates and are presented in **Figure 3**. Evapotranspiration zones identified by the California Irrigation Management Information System (CIMIS) indicate that San Diego County is home to six different evapotranspiration zones (**Figure 4**), leading to a wide variety of irrigation needs in the county. Irrigation needs are dependent on climate and vegetation type and can be determined through a series of equations relating evapotranspiration to area and plant type.

Climate data will be used in the SCFS analysis to determine potential irrigation rates and stormwater loads.

1.3 Planned and Existing Land Use

Land use enables the estimation of impervious runoff area and limits the options for feasible stormwater capture methods. Currently the region is dominated by 70% open space, 13% residential, and 6% public facilities and services (as of 2016); current plans indicate a shift in those dominant uses to 50% open space, 32% residential, and 11% public facilities and services by 2050. These data were acquired from SanGIS, which divides the county into nine categories: agriculture, commercial, industrial, open space or park, public service, residential, school, transportation, and water. SanGIS provides existing land use, as well as planned land use (for 2050), and an example of these data can be seen in **Figure 5** and **Figure 6**. These figures, and the examples following, show data for the San Diego Bay WMA. The remaining WMAs are provided in Attachment B.

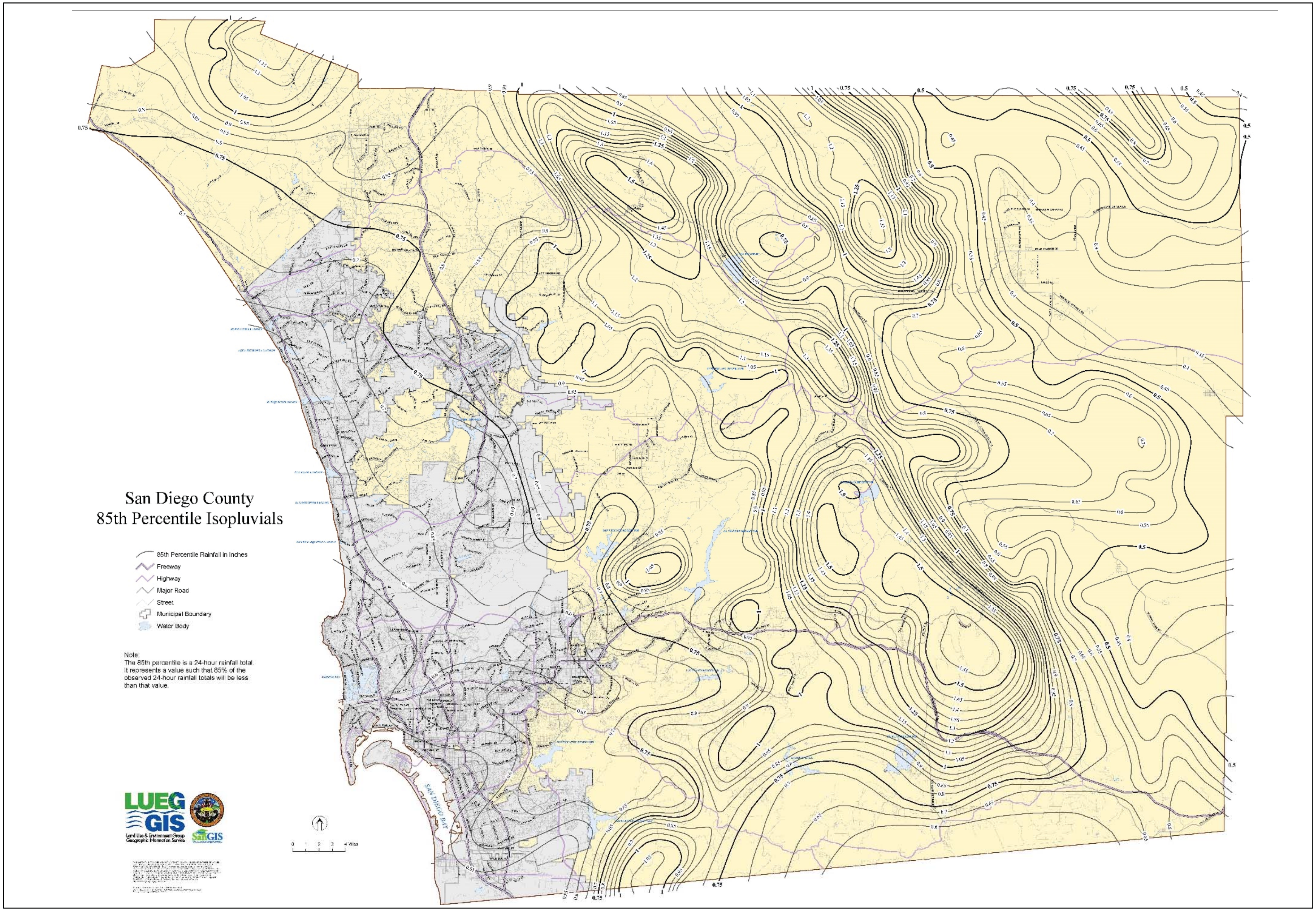
SanGIS also provides a database of roads, which can be divided into three categories with descending impervious areas and flow path potential: freeways/highways, major roads, and additional roadways. Bridge locations (point data) were also provided by California Department of Transportation (Caltrans), and the combined transportation infrastructure is shown in **Figure 7**.

Existing and planned land use will be used in the SCFS analysis to estimate the extent of existing impervious area and the potential for water management improvement via best management practices (BMPs) such as infiltration systems.

1.4 Surface Water Hydrology

Surface water systems represent natural conveyance and storage systems for stormwater, in addition to providing valuable habitat. Geographic data on streams, rivers, creeks, lagoons, and lakes is available from SanGIS and presented for the San Diego Bay WMA in **Figure 8**.

Surface water hydrology data will be used in the SCFS analysis to identify locations and systems where natural treatment flow-through systems or discharge to restore biological resources may be possible and to identify locations for any stormwater management systems that depend on runoff rate and concentration of flow.



SOURCE: LUEG GIS, San Diego County
http://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/susmppdf/susmp_85precip.pdf

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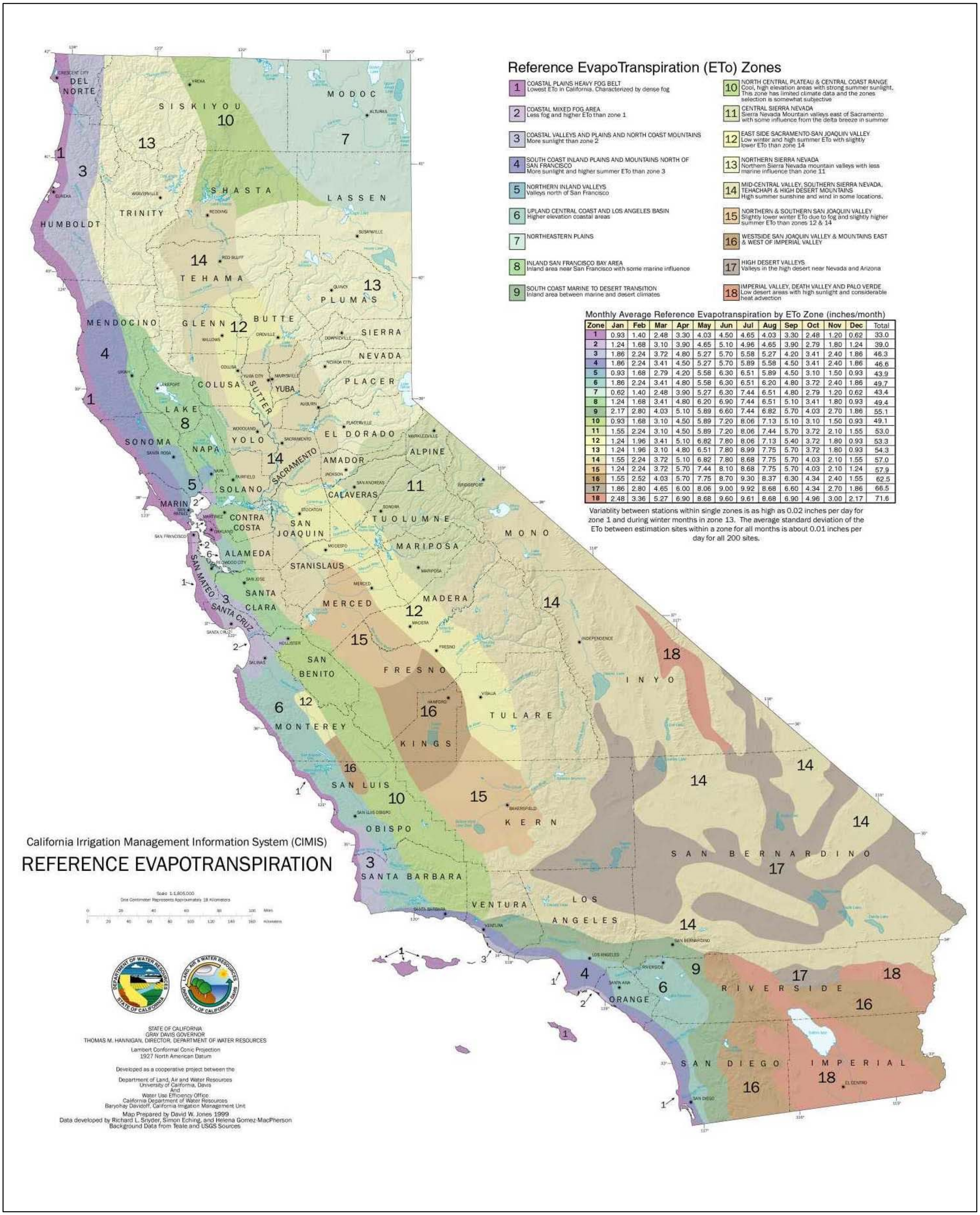
Figure 3
Isopluvials in San Diego County



Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	0.93	1.40	2.48	3.30	4.03	4.50	4.65	4.03	3.30	2.48	1.20	0.62	33.0
2	1.24	1.68	3.10	3.90	4.65	5.10	4.96	4.65	3.90	2.79	1.80	1.24	39.0
3	1.86	2.24	3.72	4.80	5.27	5.70	5.58	5.27	4.20	3.41	2.40	1.86	46.3
4	1.86	2.24	3.41	4.50	5.27	5.70	5.89	5.58	4.50	3.41	2.40	1.86	46.6
5	0.93	1.68	2.79	4.20	5.58	6.30	6.51	5.89	4.50	3.10	1.50	0.93	43.9
6	1.86	2.24	3.41	4.80	5.58	6.30	6.51	6.20	4.80	3.72	2.40	1.86	49.7
7	0.62	1.40	2.48	3.90	5.27	6.30	7.44	6.51	4.80	2.79	1.20	0.62	43.4
8	1.24	1.68	3.41	4.80	6.20	6.90	7.44	6.51	5.10	3.41	1.80	0.93	49.4
9	2.17	2.80	4.03	5.10	5.89	6.60	7.44	6.82	5.70	4.03	2.70	1.86	55.1
10	0.93	1.68	3.10	4.50	5.89	7.20	8.06	7.13	5.10	3.10	1.50	0.93	49.1
11	1.55	2.24	3.10	4.50	5.89	7.20	8.06	7.44	5.70	3.72	2.10	1.55	53.0
12	1.24	1.96	3.41	5.10	6.82	7.80	8.06	7.13	5.40	3.72	1.80	0.93	53.3
13	1.24	1.96	3.10	4.80	6.51	7.80	8.99	7.75	5.70	3.72	1.80	0.93	54.3
14	1.55	2.24	3.72	5.10	6.82	7.80	8.68	7.75	5.70	4.03	2.10	1.55	57.0
15	1.24	2.24	3.72	5.70	7.44	8.10	8.68	7.75	5.70	4.03	2.10	1.24	57.9
16	1.55	2.52	4.03	5.70	7.75	8.70	9.30	8.37	6.30	4.34	2.40	1.55	62.5
17	1.86	2.80	4.65	6.00	8.06	9.00	9.92	8.68	6.60	4.34	2.70	1.86	66.5
18	2.48	3.36	5.27	6.90	8.68	9.60	9.61	8.68	6.90	4.96	3.00	2.17	71.6

SOURCE: California Irrigation Management Information System (CIMIS)

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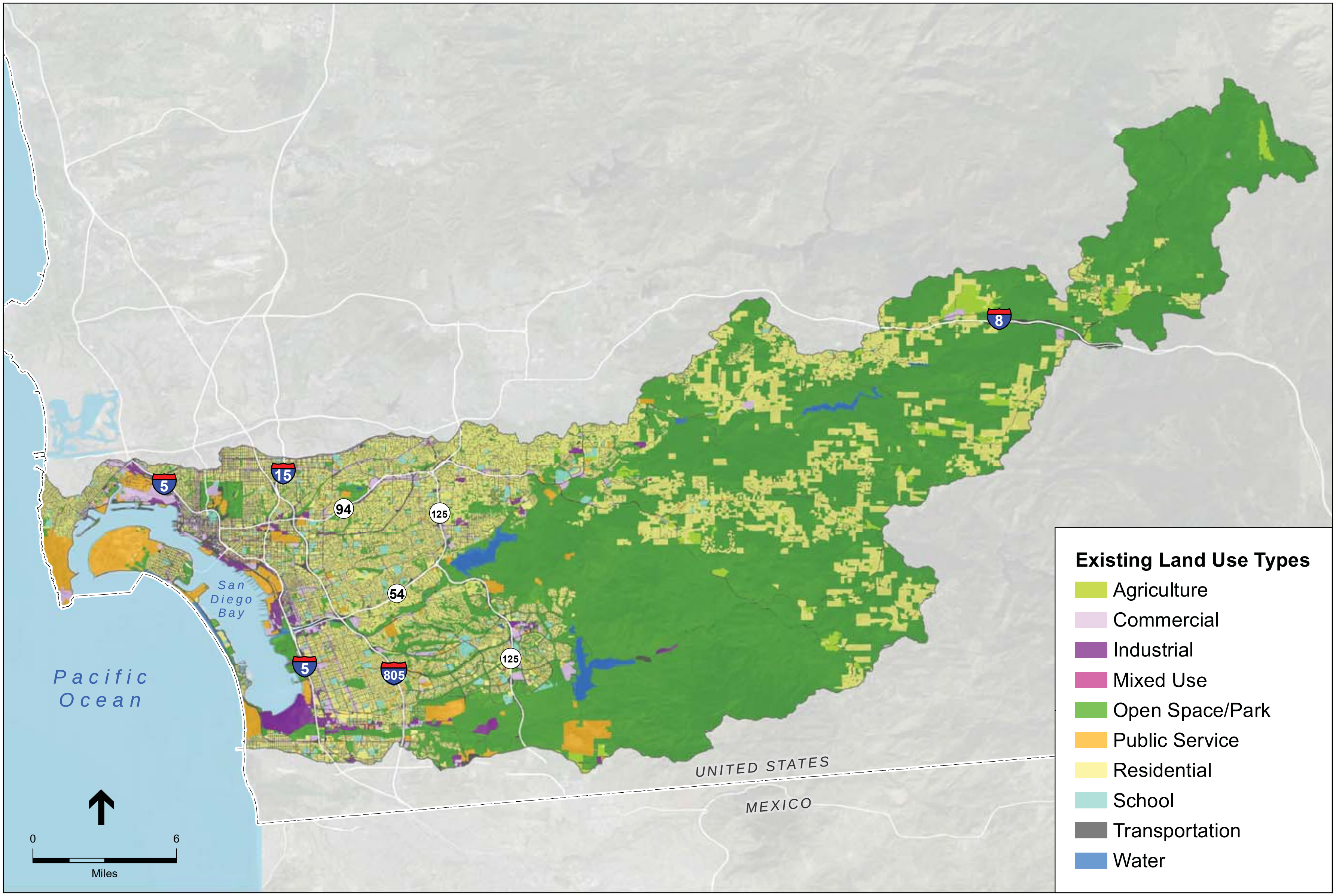
Figure 4
Evapotranspiration Zones in California



SOURCE: ESRI, 2016; SanGIS, 2016

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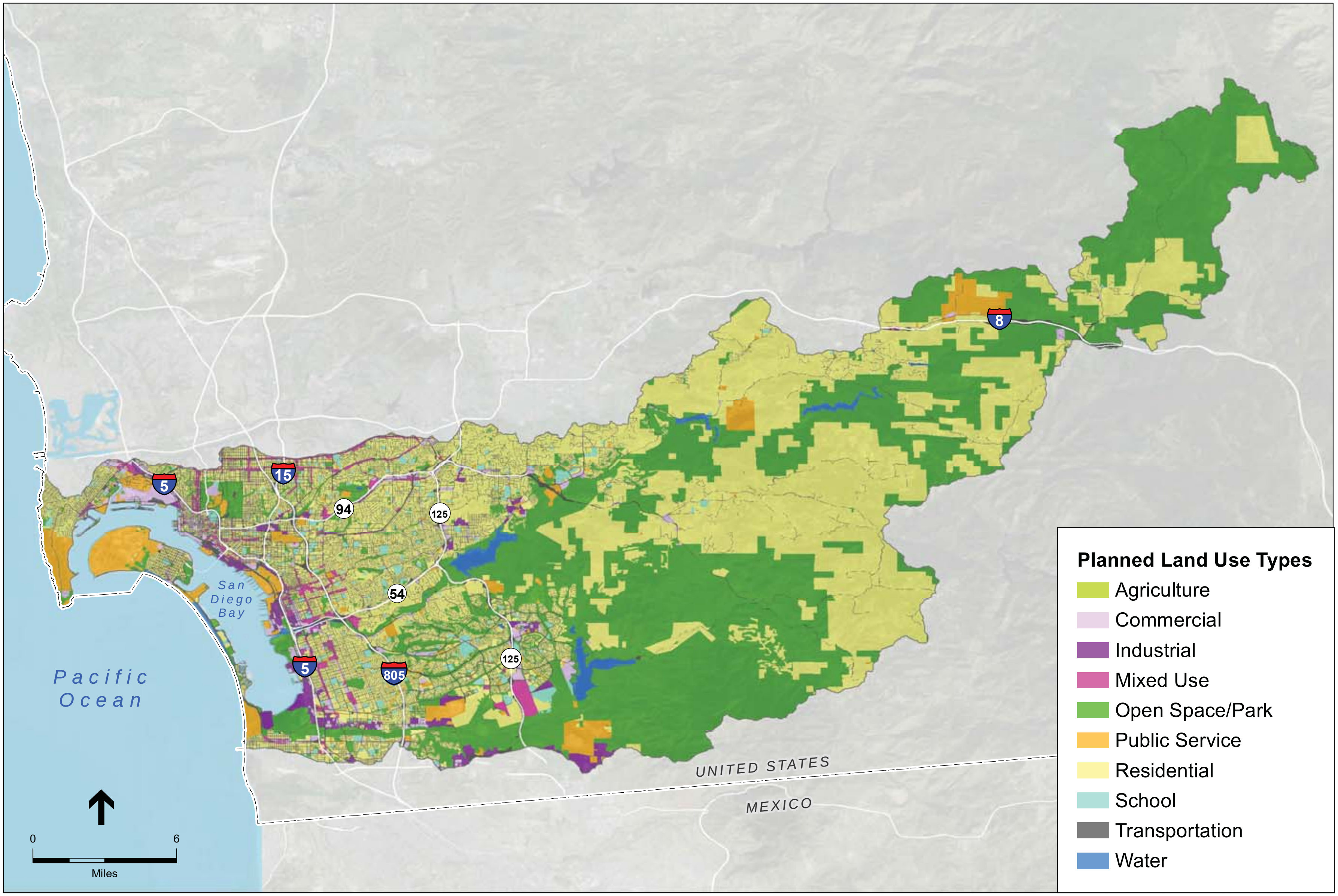
Figure 5
Existing Land Use within the San Diego Bay Watershed Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

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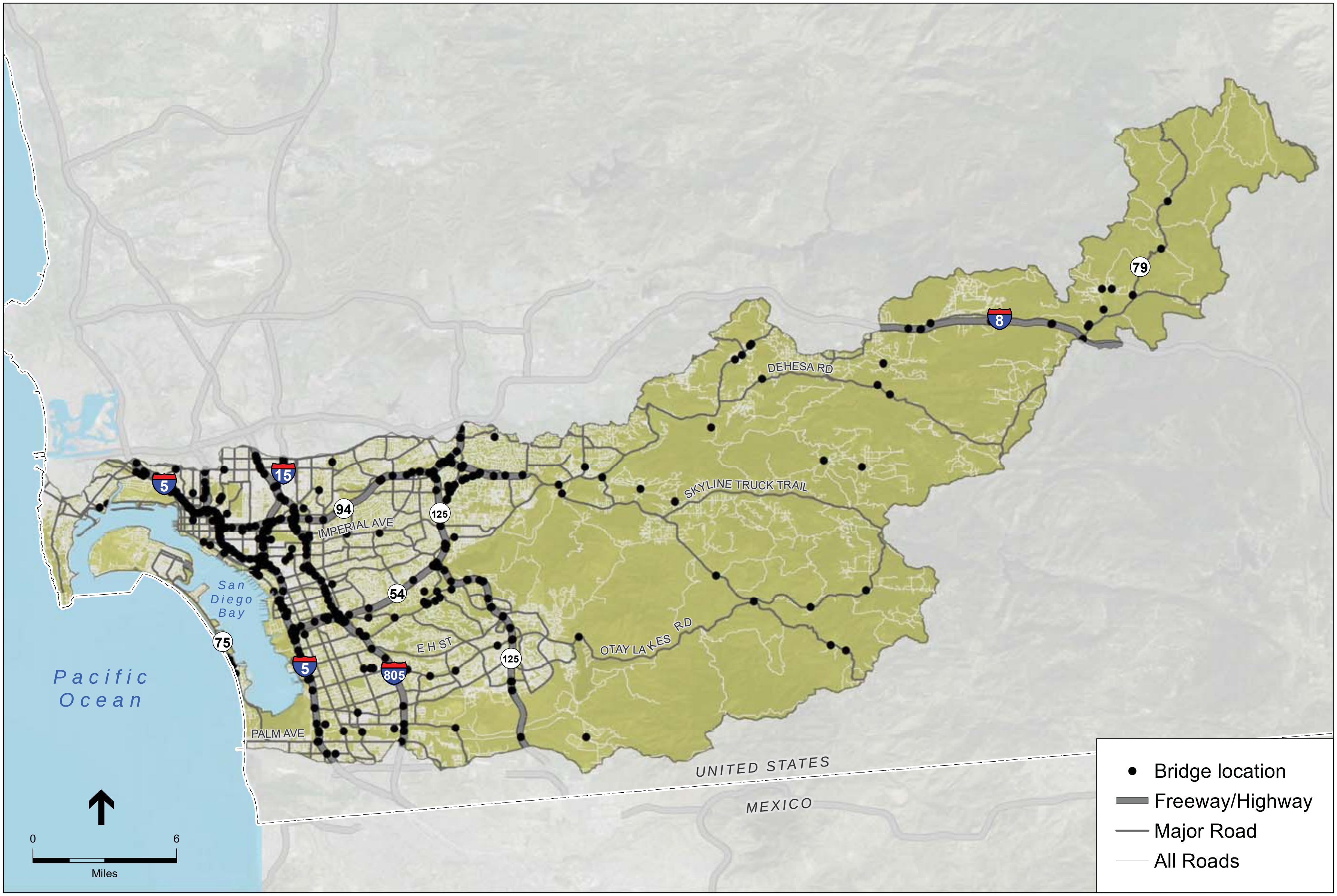
Figure 6

Planned Land Use within the San Diego Bay Watershed Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

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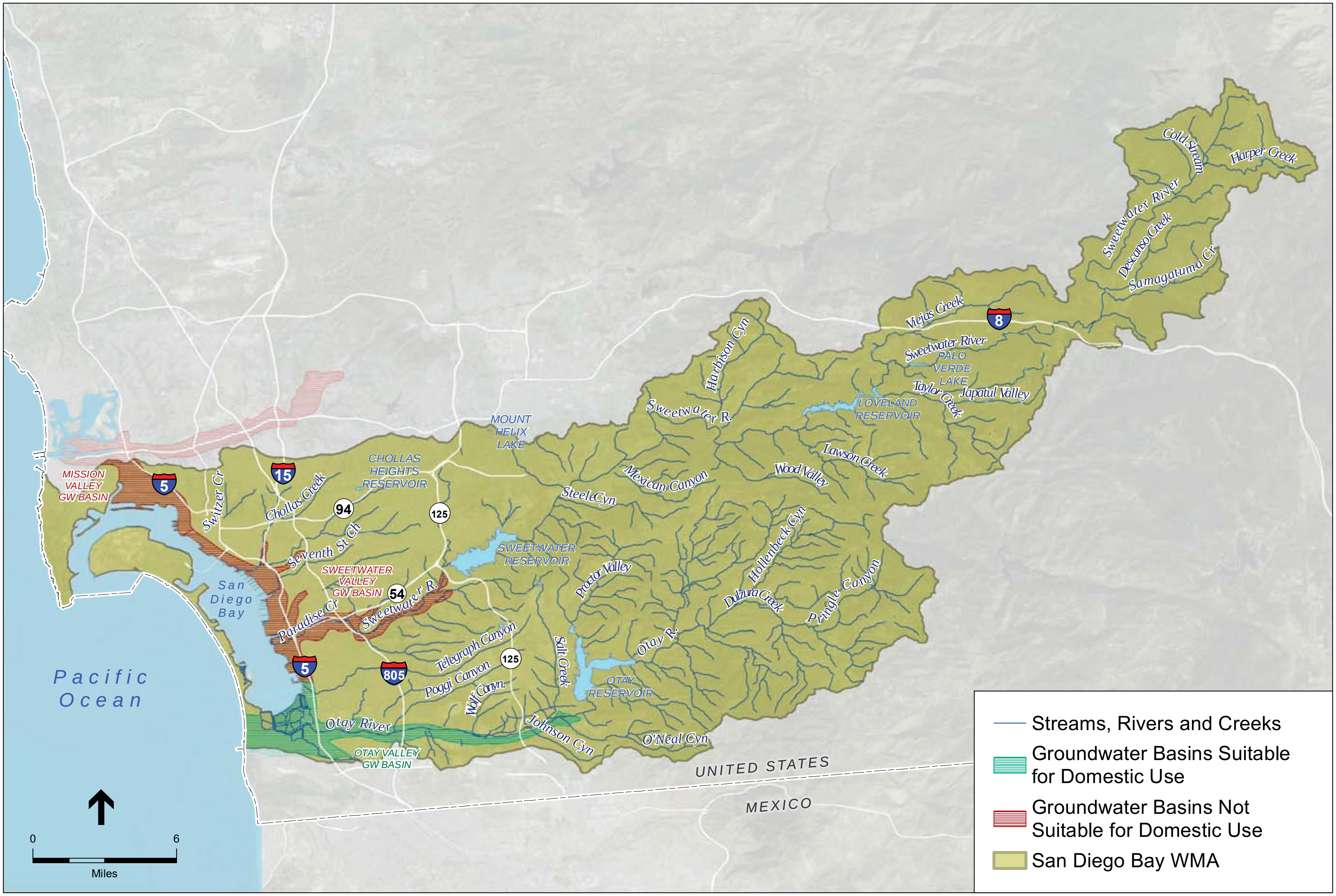
Figure 7

Built Environments within the San Diego Bay Watershed Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

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Figure 8

Water Features within the San Diego Bay Watershed Management Area

1.4.1 Runoff

Runoff rates are critical to understanding how stormwater moves through the environment and are highly dependent on the grade of the ground. Regional, GIS-based topographic analyses generally rely on large remotely-collected datasets and aerial or satellite imagery, which can often be used to perform at least a cursory check on other datasets. Two sources of imagery covering the San Diego Region are available: the US Geologic Survey (USGS) and the National Agricultural Imagery Program (NAIP), a USDA program. Topography, as shown in **Figure 9**, was taken from SanGIS, which provides a 2-foot-resolution digital elevation model over the entire county, augmented with the State Coastal Conservancy (SCC) Coastal LiDAR dataset (hosted by NOAA) in coastal regions. Slopes can be calculated in ArcMap from the LiDAR.

Natural habitat systems rely on a certain amount of stormwater and dry weather flows to maintain functioning habitats and hydrologic processes. However, some systems, such as the Los Peñasquitos Lagoon, are impacted by dry weather flows, which provide higher freshwater influence than under historical conditions. Opportunities may be available to collect these flows and reuse them beneficially, which would further improve the local habitat.

1.4.2 Native Habitats, Creeks, Lakes, Rivers, Parks, and Environmental Resources

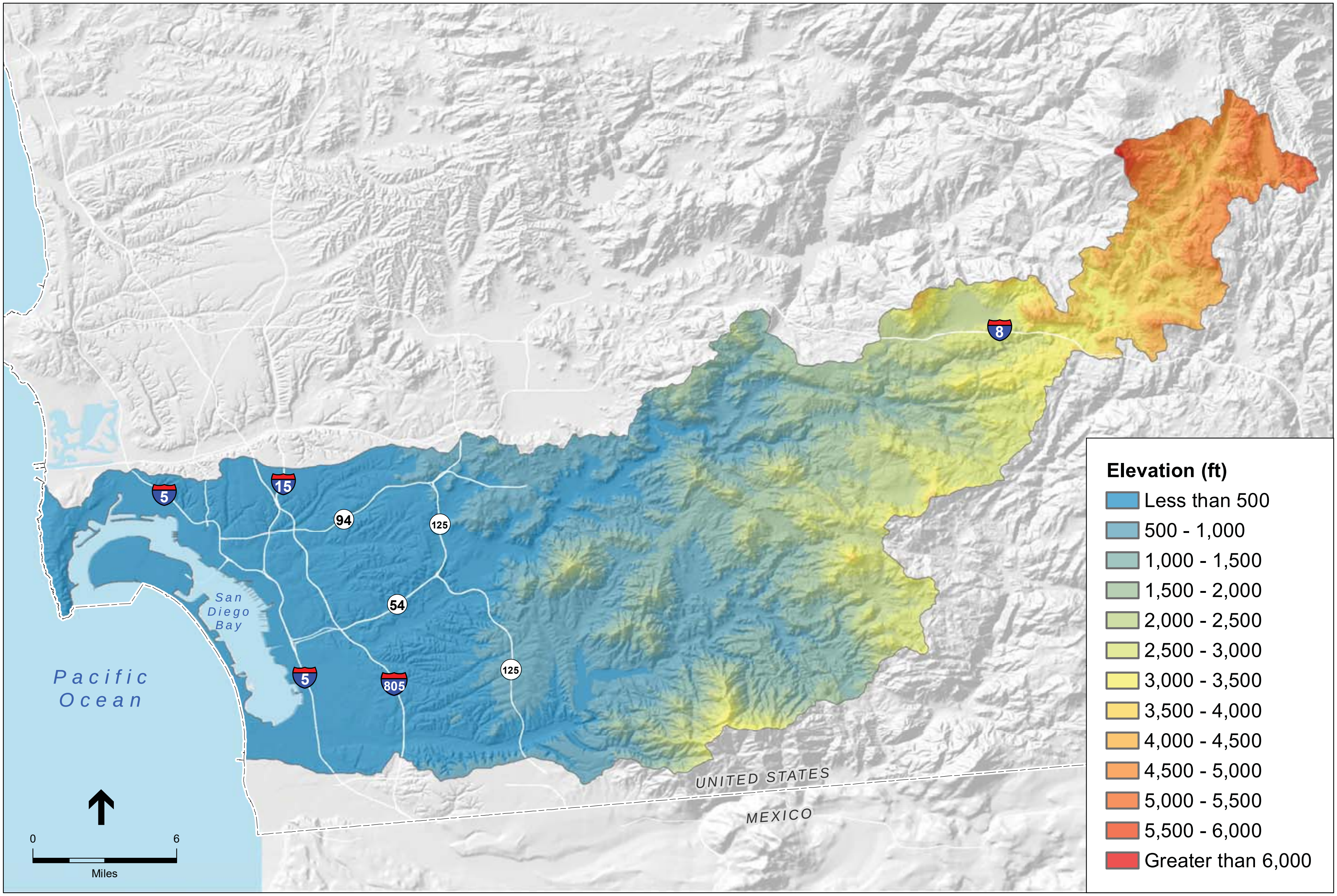
The San Diego region is home to a network of rivers, creeks, and lakes, and home to a wide array of parks and environmental resources. These can (and in some cases must) be integrated into stormwater capture and use plans, throughout the capture, retention, distribution, treatment, and release phases. Data were taken from the IRWM and SWRP, which provide detailed assessments of native habitats and environmental resources in the different watersheds of the county. See Chapter 3 of the San Diego Stormwater Resource Plan (SWRP, Section 3.6 below) for further details.

1.5 Groundwater Hydrology

Groundwater basins provide effective storage for water supply. However, in the San Diego region, there are fewer aquifers than in other regions, such as Los Angeles. **Figure 10** provides a map of groundwater basins in the county, while **Table 3** provides a list of groundwater basins in the region that are used for potable water.

Groundwater basins receive water through infiltration, which is dependent on soil characteristics. **Figure 11** shows the hydrologic soil groups in the San Diego region based on the Web Soil Survey from the US Department of Agriculture (USDA), type ‘A’ soils having the highest infiltration rate and type ‘D’ soils the lowest. Additional soil data relevant to infiltration rates is available through the Soil Agricultural Groundwater Banking Index.

One option for captured stormwater is to discharge to groundwater basins in the county for potable reuse. The locations and boundaries of groundwater basins were acquired from SanGIS and the California Statewide Groundwater Elevation Monitoring system, and the respective water levels are available from the California Department of Water Resources (DWR) Groundwater Information Center. The USGS National Water Information System provides locations of active wells, along with water quality, annual yield, and depth to groundwater for each well. The State Water Resource Control Board’s (SWRCB) GeoTracker Groundwater Ambient Monitoring and Assessment Program provides chemical data for wells for the past 10 years.



SOURCE: ESRI, 2016; SanGIS, 2016

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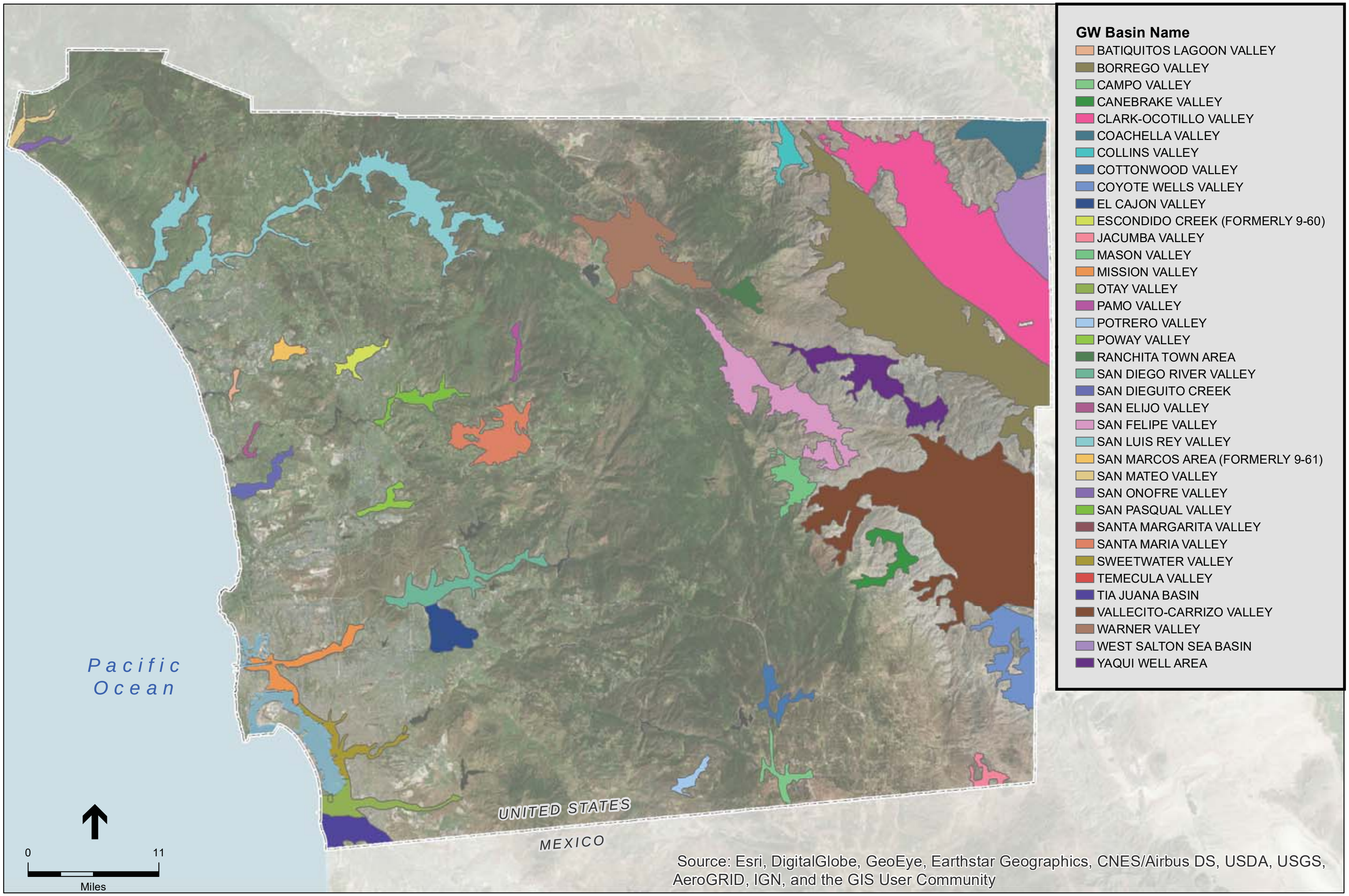
Figure 9
Topography within the San Diego Bay Watershed Management Area



SOURCE: SANDAG, 2016

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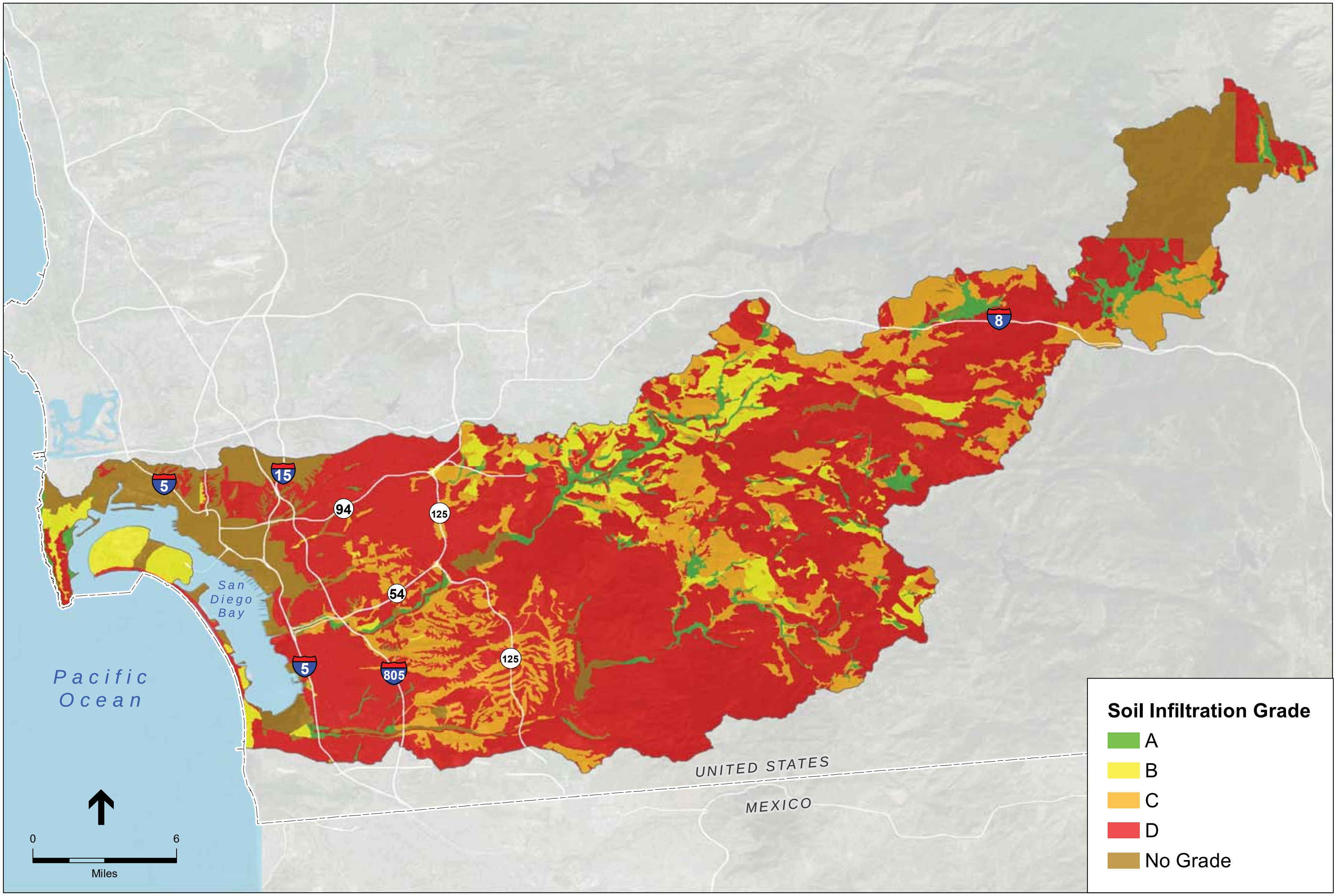
Figure 10

Groundwater Basins within San Diego County

ESA



SOURCE: ESRI, 2016; SanGIS, 2016

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Figure 11

Soil Infiltration Grades within the San Diego Bay Water Management Area

TABLE 3
GROUNDWATER BASINS USED FOR POTABLE WATER

Potable Groundwater Basin	Water Management Agency
Batiquitos Lagoon Valley	Carlsbad
Campo Valley	Tijuana
Cottonwood Valley	Tijuana
el cajon valley	San Diego River
Escondido Creek (formerly 9-60)	Carlsbad
Mission Valley	Mission Bay/ San Diego River/ San Diego Bay
Otay Valley	San Diego Bay/ Tijuana
Pamo Valley	San Dieguito
Potrero Valley	Tijuana
Poway Valley	Los Penasquitos
Ranchita Town Area	San Luis Rey
San Diego River Valley	San Diego River
San Dieguito Creek	San Dieguito
San Elijo Valley	Carlsbad
San Luis Rey Valley	San Luis Rey/ Santa Margarita
San Marcos Area (formerly 9-61)	Carlsbad
San Pasqual Valley	San Dieguito
Santa Margarita Valley	Santa Margarita
Santa Maria Valley	San Dieguito
Sweetwater Valley	San Diego Bay
Temecula Valley	Santa Margarita
Tiajuana Basin	Tijuana/ San Diego Bay
Warner Valley	San Luis Rey

Groundwater and groundwater basin data will be used in the SCFS analysis to determine the feasibility of discharging captured stormwater into potable groundwater basins.

1.6 Water Quality

When stormwater is captured and reused, certain water quality standards must be met for different beneficial uses. California upholds a complex network of regulations governing water use (addressed in Section 2), which require data collection on water quality, plans to improve water quality, and regulations to ensure that plans are being implemented. Existing water quality data is available through the California Environmental Data Exchange Network (CEDEN), which hosts monitoring data used in composing the WMAs' Water Quality Improvement Plans (WQIPs) and the Jurisdictional Runoff Management Plans (JRMPs) produced by jurisdictions in the region.

Water quality data will be used in the SCFS analysis to determine treatment needs for stormwater prior to discharge and to ensure that discharge to natural systems do not significantly deviate from current or target conditions.

1.7 Water and Wastewater

In many areas of the county, stormwater falls on or flows through developed areas. These built environments are home to a variety of infrastructure that provide both conveyance, storage, and treatment of potable water, wastewater, and stormwater.

Data regarding water and wastewater systems will be used in the SCFS analysis to identify opportunities to inject stormwater into these systems to increase clean water supplies in the county.

1.7.1 Boundaries for Municipalities and Service Areas

There are 18 municipalities in the county, and their boundaries were taken from SanGIS. District service area boundaries for the county's 23 water agencies, wastewater agencies, and community service districts are provided in the San Diego Integrated Regional Water Management Plan (IRWM). Some areas, such as those controlled by the Bureau of Land Management (BLM), were reported by the agencies themselves: BLM Lands, BLM Wilderness Areas, BLM National Conservation Areas, US Fish and Wildlife Service Refuges. SanGIS was also used to define the boundaries for military facilities, Native American reservation lands, and national forests in the county.

1.7.2 Distribution Facilities

If stormwater needs to be treated before delivery to its end users, the treatment facilities and their intake and distribution networks are important datasets. The IRWM identifies and locates 12 water treatment plants, recycled water treatment plants, and wastewater treatment plants, and this was augmented with locations of advanced treatment plants. In addition to advanced treatment plants, pump station locations, stormwater flow data, wastewater flow data, wastewater influent quality data, and information on water demand in the county was collected. Though this is far more data than available through the IRWM and SanGIS, the dataset is still considered partial. The Project Team has extensive data and internal contacts at a subset of water treatment plants, and plans to pursue these as case studies, using them as representatives for the water treatment facilities of the county.

1.8 Stormwater Conveyance and Collection

Due to its geography and hydrology, San Diego is subject to drought and flood cycles, which has led to a wide network of stormwater flood control infrastructure in the county. Stormwater is commonly captured and conveyed by a storm drain system, including underground culverts and aboveground channels, then detained in basins and reservoirs for beneficial use or controlled release.

Stormwater control and collection system data will be used in the SCFS analysis to determine where stormwater can be collected under current conditions, and to find beneficial use options close enough to these locations to make them feasible.

1.8.1 Stormwater Control and Conveyance

The locations and features of stormwater conveyance systems were collected from the different cities through SanGIS, the National Hydrology Dataset (NHD, provided by USGS), previous work done by the Project Team, and direct contact with cities such as Chula Vista, Del Mar, Encinitas, Lemon Grove, Oceanside, and Solana Beach. Furthermore, stormwater is subject to Municipal Separate Storm Sewer System (MS4) permits, so a list of the existing MS4 permits (and their municipalities) were collected from the Copermittees for the Stormwater Resource Plan (SWRP). (For more information on the MS4 permit, see Section 2.3.1).

As of August 29, 2017, the Project Team has reached out to the remaining cities of Carlsbad, Coronado, Del Mar, El Cajon, Escondido, La Mesa, National City, Poway, San Marcos, Santee, Vista, and Imperial Beach, but is still waiting to obtain conveyance system data from them. If this data does not become available, the SCFS analysis will rely on LiDAR data to identify conveyance channels and use google earth and possibly site visits as needed to identify drainage in areas used for project designs.

1.8.2 Stormwater Collection and Detention

There are many facilities and infrastructure elements in the San Diego region that serve stormwater functions. For example, impoundments retain stormwater (often for water quality purposes), spreading grounds allow for improved infiltration, flood control basins retain stormwater to control distribution and arrival of high water flows, and debris basins capture large objects carried by the flow. These are mainly related to the capture, distribute, and retain goals of stormwater capture feasibility, though they also play into beneficial use options.

1.8.2.1 Centralized Stormwater Capture Facilities

Stormwater capture can be distributed through many small features over a large area, or it can be focused into a few large capture and retention systems; often, capture infrastructure over an area the size of the San Diego region is a combination of the two. As such, it is valuable to know the location and type of existing centralized stormwater capture facilities when assessing the feasibility of expanding the broader system. While some reservoir and detention basin information was available through SANGIS and the USGS NHD, there are still data gaps being filled through direct outreach and through contacts in the project's Technical Advisory Committee (TAC).

1.8.2.2 Distributed Stormwater Capture Facilities

It is important to know the location and type of existing distributed capture facilities, though it can be more difficult that for centralized facilities (Section 1.8.2.1), since distributed systems are naturally smaller and more diffuse. San Diego County provides rebates to encourage small-scale stormwater capture on private property (i.e. rain barrels), as advocated by agencies such as the Solana Center for Environmental Innovation. Several sites with distributed stormwater capture infrastructure were also identified in conjunction with the project's TAC and the San Diego Regional Climate Collaborative, which are described in Section 1.9.

1.8.3 Green Infrastructure Projects

San Diego is home to a growing number of green infrastructure projects, integrating infrastructure improvements – such as street construction – with stormwater best management practices – such as infiltration basins. These green infrastructure projects are becoming increasingly common and represent a wide network of distributed stormwater capture facilities, though they are generally not interconnected or planned in conjunction with each other. In assessing the feasibility of a county-wide stormwater capture plan, these existing systems must be identified and considered. Several example sites have been located in the region, ranging from green streets to sustainable construction plans to infiltration gardens (See Section 1.9).

1.9 Potential Example Projects

As part of the data request from the TAC meeting, the Project Team received a number of example stormwater capture and beneficial use projects for consideration in use in the analysis step of this project. Existing stormwater projects may be used, where applicable, as examples in the SCFS analysis to develop more refined quantification and costs for potential beneficial uses of stormwater. **Table 4** provides a summary of the projects that are potential examples and that may or may not be used in the analysis, but could provide a basis to refine quantities and costs.

1.10 Historical Climate Condition and Future Climate Change

Accurate stormwater management strategies require climate data under current and future conditions, focusing on coastal water levels and inland precipitation patterns. NOAA provides coastal water levels under current conditions based on long-term observations. They also provide a regression for these observations with time, indicating any observed trend in water level. For example, NOAA has recorded an average increase of 2.17mm/year at their gauge in La Jolla, CA, over the course of their 92-year record. Climate and hydrology other than sea levels are provided in the form of downscaled projections from the “Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections” archive, maintained by a group of public, private, and academic partners. This dataset includes precipitation, temperature, and runoff depth across the county.

Projections of future climate conditions will be used in the SCFS analysis to address uncertainty around the amount and distribution of stormwater in the county to better assess the sustainability of existing and proposed infrastructure.

2. Regulatory Framework for Stormwater Capture

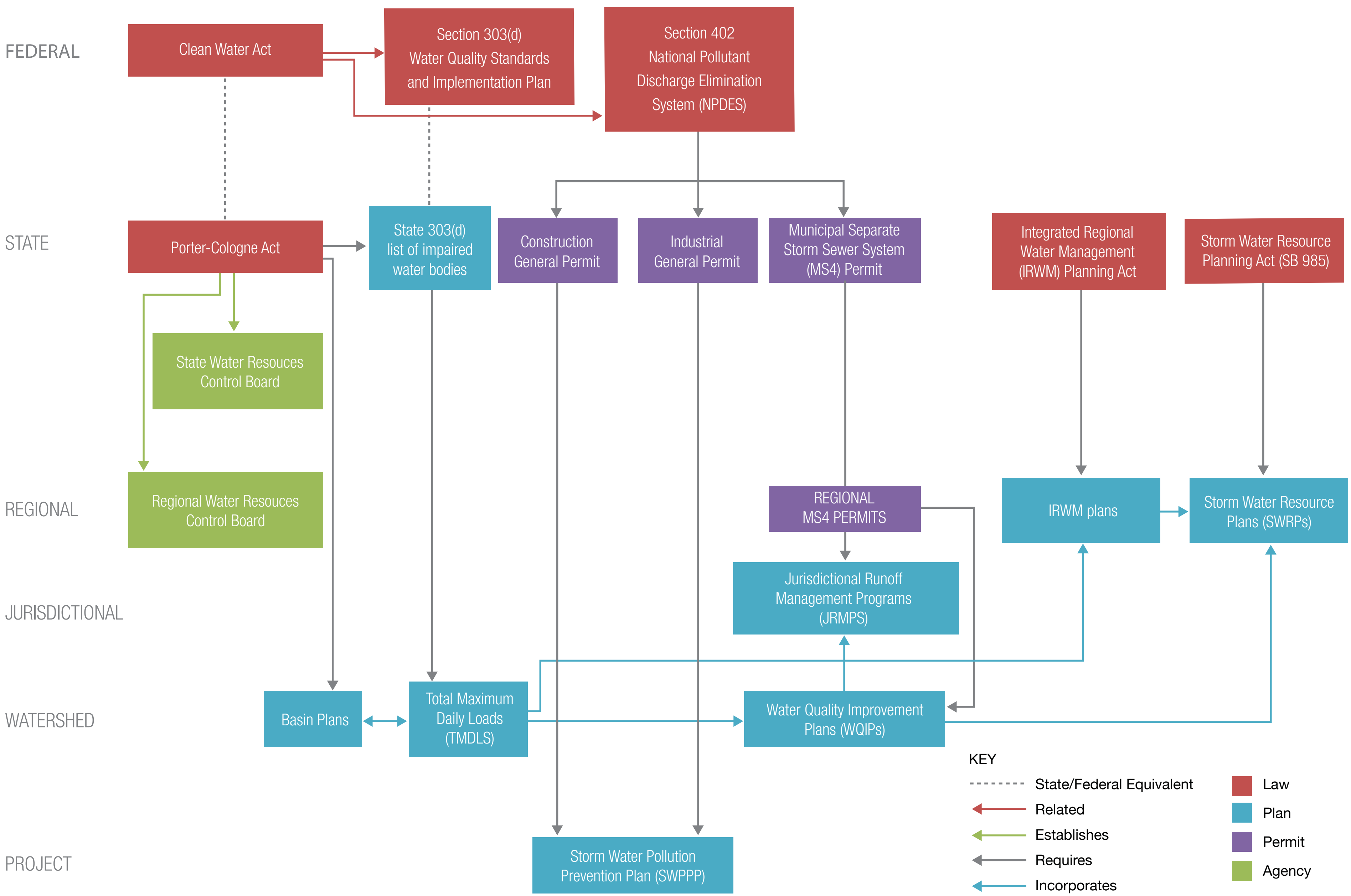
Regulatory authorities exist on the federal, state, and regional levels for the protection of water quality in California. With regard to water quality management responsibilities, the USEPA is the federal agency pursuant to the Clean Water Act, and the SWRCB is the state agency pursuant to the Porter-Cologne Act. The San Diego Regional Water Quality Control Board (SDRWQCB), implements water quality regulations throughout the San Diego Region, including the County of San Diego areas.

Figure 12 provides a flow chart of California water quality legislation, the associated permits reflecting this legislation, and required plans for compliance with these permits. Background on these permits and plans is described below. Additionally, **Table 5** provides a summary of how these permits and plans relate to the different stormwater beneficial uses identified above.

TABLE 4
POTENTIAL EXAMPLE PROJECTS AND CORRESPONDING BENEFICIAL USES

		Benefits							
Project	**Description**	**A. Infiltration for potable use**	**B. Infiltration for hydrology**	**C. Irrigation on public lands**	**D. Irrigation on private lands**	**E. Restoration and treatment wetlands**	**F. Discharge to WWTP during low flows**	**G. Discharge to WWTP for potable use**	**H. Discharge to WWTP for recycled water use**
"A" Avenue Green Street in National City	• Low-impact design to collect and infiltrate stormwater • Water is collected in an underground cistern then used to water Kimball Park • Water is then discharged to Paradise Creek to improve natural flows		✓	✓		✓			
Wastewater Treatment Plants	• Several plants identified as potential case studies						✓	✓	✓
Chollas Creek Enhancement Program	• Enhancement aimed at maintaining natural drainage patterns, recharging the creek aquifer, controlling erosion, and enhancing water quality through creek-bed infiltration		✓	✓		✓			
Kaiser Permanente San Diego Central Medical Center	• Pervious pavement and decomposed granite pathways to improve infiltration and reduce runoff • Landscaping designed to capture and retain stormwater through infiltration and biofiltration BMPs • Collected water supports irrigation and water features fed with recycled water		✓		✓				
Stone Brewing World Bistro and Gardens	• Developed to recycle water from the brewing facility and to act as a detention basin for stormwater runoff • Includes a bioretention facility and a rain garden	✓			✓				

WWTP = Waste water treatment plant



SOURCE: ESA

SWRP . 160618

Figure 12

California Water Quality Legislation

Table 5
Regulatory Framework for Beneficial Uses

Benefit	Clean Water Act	CA Water Code	Porter-Cologne WQ Control Act	Constr. General Permit	State Industrial General Permit	State 303(d) List	CEQA	SB 985	AB 2403	20/20 Potable Water Reduction	Sustainable Groundwater Management Act	CA Health and Safety Code	CA Water Recycling Criteria	SD MS4 Permit	WQ Control Plan for SD Basin	County of SD JRMP	County of SD Watershed Protection, Stormwater Management, and Discharge Control Ordinance	SD County Groundwater Ordinance	SD County Zoning Ordinance	SD Basin Study
Section	**2.1.1**	**2.2.1**	**2.2.2**	**2.2.3**	**2.2.4**	**2.2.5**	**2.2.6**	**2.2.7**	**2.2.8**	**2.2.9**	**2.2.10**	**2.2.11**	**2.2.12**	**2.3.1**	**2.3.2**	**2.3.3**	**2.3.4**	**2.3.5**	**2.3.6**	**2.3.7**
A. Infiltration for potable use	✓	✓	✓	✓		✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
B. Infiltration for hydrology	✓	✓	✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	
C. Irrigation on public lands	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓
D. Irrigation on private lands	✓	✓	✓	✓		✓							✓						✓	✓
E. Restoration and treatment wetlands	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	
F. Discharge to WWTP during low flows	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓
G. Discharge to WWTP for potable use	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓
H. Discharge to WWTP for recycled water use	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓

CA = California
WQ = Water quality
CEQA = California Environmental Quality Act
SB = Senate Bill
AB = Assembly Bill
SD = San Diego
MS4 = Municipal Separate Storm Sewer System
JRMP = Jurisdictional Runoff Management Program
WWTP = Wastewater treatment plant

2.1 Federal

2.1.1 Federal Water Pollution Control Act (Clean Water Act)

The principle federal law pertaining to the regulation of water quality is the 1972 Federal Water Pollution Control Act (Clean Water Act) (EPA 2015). The Clean Water Act strives to restore and maintain the chemical, physical, and biological integrity of the nation's water. The act sets up a system of water quality standards, discharge limitations, and permits. The fundamental purpose of this law is the protection of designated beneficial uses of water resources. Sections 106, 205(g), 205(j), 208, 303, and 305 of the Clean Water Act establish requirements for state water quality planning, management, and implementation with regard to surface waters. The Clean Water Act requires that states adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act. California adopted the Porter-Cologne Water Quality Control Act in 1969, as discussed below.

The Clean Water Act was amended in 1987 to include urban and stormwater runoff, which required many cities to obtain a National Pollutant Discharge Elimination System (NPDES) permit for stormwater conveyance system discharges. Section 402(p) of the Clean Water Act prohibits discharges of pollutants contained in stormwater runoff, except in compliance with an NPDES permit.

In 1972, the Clean Water Act was amended to state that discharge of pollutants to waters of the United States from any point source is unlawful unless the discharge is in compliance with a NPDES permit (SWRCB 2013). General permits establish essential regulatory requirements for a broad range of activities. NPDES permits that apply to the San Diego Region include the Construction General Permit, the Industrial General Permit, and the MS4 Permit. These permits are described in more detail below.

2.2 State

2.2.1 California Water Code

The California Water Code contains provisions which control almost every consideration of water and its use. Division 2 of the Water Code provides that the State Board shall consider and act upon all applications for permits to appropriate waters. The State Board's authority includes water quality considerations in granting a water right. Division 3 deals with dams and reservoirs; Division 5 pertains to flood control; Division 6 controls conservation, development and utilization of the state water resources; Division 7 covers water quality protection and management (Porter-Cologne Water Quality Control Act); and Divisions 11 through 21 provide for the organization, operation, and financing of municipal, county and local water-oriented agencies.

Groundwater management is outlined in the California Water Code, Division 6, Part 2.75, Chapters 1-5, Sections 10750 through 10755.4. The Groundwater Management Act was first introduced in 1992 as AB 3030, which provided a systematic procedure for an existing local agency to develop a Groundwater Management Plan. It has since been modified by SB 1938 in 2002, which required any public agency seeking State funds administered through DWR for the construction of groundwater projects to prepare and implement a Groundwater Management Plan with specified required components. In 2011, AB 359 included additional required components to focus on identifying groundwater recharge areas, and included several plan adoption procedural changes.

2.2.2 Porter-Cologne Water Quality Control Act

California implemented the Porter-Cologne Water Quality Control Act (Water Code Section 13000 et seq.) in 1969. The Porter-Cologne Act established the State Water Resources Control Board (SWRCB) and divided California into nine regions, each overseen by a Regional Water Quality Control Board (RWQCB), such as the San Diego Regional Water Resources Control Board (SDRWQCB). The Porter-Cologne Act names these Boards and designates them as "the principal State agencies with primary responsibility for the coordination and control of water quality" (Section 13001). Each Regional Board is directed to "formulate and adopt water quality control plans for all areas within the region." A water quality control plan for the waters of an area is defined as having three components: (1) beneficial uses which are to be protected, (2) water quality objectives which protect those uses, and (3) an implementation plan which accomplishes those objectives (Section 13050). In California, all surface waters and groundwater are considered to be "Waters of the State." The Clean Water Act and the Porter-Cologne Act established several permits and plans, including the Water Quality Control Plans (basin plans, explained below) and the NPDES.

2.2.3 Construction General Permit

Construction projects (or projects that are part of a larger development plan) that disturb one or more acres of ground surface must obtain coverage under the Construction General Permit (2009-0009-DWQ as amended by 2010-0014-DWQ and 2012-0006-DWQ). Compliance with the Construction General Permit requires the preparation and implementation of a project-specific Storm Water Pollution Prevention Plan (SWPPP). The SWPPP describes which BMPs will be implemented on site, where they will be located to prevent pollutants from contacting stormwater, and how they will impede polluted runoff from moving off site into receiving waters. Categories of BMPs include erosion control, sediment control, waste management, good housekeeping, and post-construction. The SWPPP must also detail any pertinent monitoring and sampling requirements to be performed throughout the construction period, which are identified in the Construction General Permit and are dependent on the sediment and receiving water risk level of the site. Compliance with the Construction General Permit is implemented and enforced by the SWRCB, which runs the Storm Water Multiple Application and Report Tracking System website, where storm water permit documents are electronically filed. The SWRCB also processes all Notice of Intent documents prepared by projects intending to comply with the Construction General Permit (SDRWQCB 2016d).

2.2.4 State Industrial General Permit

The SWRCB adopted the most recent version of the Industrial General Permit in July of 2015 (Order 2014-0057-DWQ). The purpose of this permit is to protect water quality during industrial operations. A SWPPP must be prepared that includes BMPs to be implemented throughout the site operation. BMPs must include all minimum BMPs identified in the Industrial General Permit that are required for all facilities, along with any applicable advanced BMPs. The SWPPP also requires monitoring. Minimum BMP types include good housekeeping, preventative maintenance, spill and leak prevention and response, material handling and waste management, erosion and sediment control, quality assurance, and record keeping. Operation of industrial facilities must comply with discharge prohibitions, effluent limitations, receiving water limitations, and TMDLs for receiving waters. Monitoring and receiving water sampling requirements for the facility must also be detailed in the SWPPP. The Industrial General Permit requires each facility to have a Pollution Prevention Team established and responsible for assisting with the implementation of the requirements in the Permit (SWRCB 2017).

2.2.5 State 303(d) List of Impaired Water Bodies

The Clean Water Act Section 303(d) requires states to identify waters that do not meet certain water quality standards and develop total maximum daily loads (TMDLs) for them. Additionally, TMDLs are programs for implementation of existing water quality standards and are established in the Regional Basin Plan subject to the requirements of the state Water Code Section 13242.

A TMDL is a quantitative assessment of water quality problems, contributing sources, and load reductions or control actions needed to restore and protect bodies of water. The TMDL approach provides a framework for evaluating pollution control efforts and for coordination between federal, state, and local efforts to meet water quality standards. TMDLs are adopted as amendments to the region's basin plan (SDRWQCB 2016a).

A TMDL project may consist of a single water body and pollutant, or a combination of multiple water bodies and pollutant listings to restore impaired water bodies (SDRWQCB 2016b). SDRWQCB works collaboratively with stakeholder groups to address its impaired water bodies and define TMDLs. The development steps include assessing the water body, defining total loads, developing allocations, and implementation plans to address the water quality impairment(s) (SDRWCB 2016c).

Table 6 below lists the TMDLs that have been adopted within the San Diego Region, along with their adoption date.

2.2.6 California Environmental Quality Act

The California Environmental Quality Act (CEQA) was enacted by the state legislature in 1970 and is contained in the Public Resources Code sections 21000 through 21177. The overall objectives of CEQA are to provide full public disclosure of a project and to ensure that environmental factors are considered in the decision making process. Under CEQA, lead agencies are required to consider impacts to groundwater, water quality, and hydrology when considering discretionary actions.

2.2.7 Senate Bill 985

On August 28, 2014 the California State Legislature passed Senate Bill (SB) 985. SB 985 authorizes a city, county, or special district to develop a Stormwater Resource Plan (SWRP) as an eligibility requirement for an entity to receive grant funding for a storm water and/or urban runoff project. Stormwater resource plans list and prioritize projects geared toward capturing stormwater for underground storage, thus increasing local groundwater supplies and reducing the need to purchase imported water. The San Diego Regional SWRP was published in March 2017, as detailed above in Section 1.4.1.

2.2.8 Assembly Bill 2403

Assembly Bill (AB) 2403 was passed in 2014 by the California Legislature. The bill expands the statutory definition of water to specifically include recycled water and reclaimed stormwater for the provision of water service and exemption from the election requirement for all property-related fees under Proposition 2018 of 1996 (County of Los Angeles 2014).

TABLE 6
TMDLS ADOPTED BY SDRWQCB FOR THE SAN DIEGO REGION

Adopted TMDLs	Adoption Date
Chollas Creek Diazinon TMDL	August 14, 2002
Rainbow Creek Nitrogen and Phosphorus TMDLs	February 9, 2005
Shelter Island Yacht Basin Dissolved Copper TMDL	February 9, 2005
Chollas Creek Copper, Lead and Zinc TMDLs	June 13, 2007
Indicator Bacteria: Revised Project I – Twenty Beaches and Creeks in San Diego Region (including Tecolote Creek)	February 10, 2010
Indicator Bacteria: Project II – Baby Beach in Dana Point Harbor and Shelter Island Shoreline Park in San Diego Bay	June 11, 2008
Los Peñasquitos Lagoon Sediment TMDL	June 13, 2012
Adopted Alternative Approach TMDL	**Adoption Date**
Loma Alta Slough TMDL Phosphorus	June 26, 2014
TMDLs in Progress for the San Diego Region	
San Diego Bay Marine Sediments TMDLs: Mouth of Chollas Creek Seventh Street Channel (Paleta Creek) Switzer Creek B Street/Broadway Piers Downtown Anchorage Naval Station Submarine Base	
TMDLs for Impaired Lagoons, Adjacent Beaches, and Agua Hedionda Creek	
Tijuana River and Estuary	
Famosa Slough	
Santa Margarita River Estuary	

SOURCE: SDRWQCB 2016b, 2016c

2.2.9 20/20 Statewide Mandatory Potable Water Reduction

In January of 2014, the Governor Brown proclaimed a State of Emergency due to prolonged drought and directed state officials to take all necessary actions to make water immediately available. Key measures in the proclamation included asking all Californians to reduce water consumption by 20 percent, directing local water suppliers to immediately implement local water shortage contingency plans, and directing DWR and the Board to accelerate funding for projects that could enhance water supplies.

Following unprecedented water conservation and plentiful rain, on April 7, 2017, Governor Brown ended the drought State of Emergency in most of California, while maintaining water reporting requirements and prohibitions on wasteful practices (SWRCB 2017). Executive Order B-40-17 lifts the drought emergency in all California counties except Fresno, Kings, Tulare, and Tuolumne. The State Water Resources Control Board maintains urban water use reporting requirements and prohibitions on wasteful practices such as watering during or after rainfall, hosing off sidewalks and irrigating ornamental turf on public street medians. As directed by

Governor Edmund G. Brown Jr. in Executive Order B-37-16, the Board will separately take action to make reporting and wasteful water practices permanent.

2.2.10 Sustainable Groundwater Management Act

In September 2014, the Sustainable Groundwater Management Act (SGMA) was signed, allowing local agencies to customize groundwater sustainability plans. The SGMA is a three-bill legislative package, composed of AB 1739, SB 1168, and SB 1319. The SGMA empowers local agencies to adopt groundwater management plans that are tailored to the resources and needs of their communities (DWR 2017b). The SGMA provides for sustainable management of groundwater basins; enhances local management of groundwater consistent with rights to use or store groundwater; provides local groundwater agencies with the authority, technical, and financial assistance needed to maintain groundwater supplies; and avoids or minimizes impacts for land subsidence.

2.2.11 California Health and Safety Code

In 1939, the California Legislature established the Health and Safety Code, consolidating and revising the law relating to the preservation of the public's health and safety. The Code includes sections pertaining to a wide variety of health and safety subjects, including but not limited to public health, sanitation, safe drinking water, and buildings used by the public. The California Health and Safety Code Division 104, Environmental Health, Part 12 includes, but is not limited to, California's Safe Drinking Water Act, water supply provisions, water equipment and control requirements, and water treatment devices.

2.2.12 California Water Recycling Criteria (CCR Title 22)

All recycled water in California, including stormwater captured for beneficial use, is subject to Title 22 of California's Water Recycling Criteria (California Code of Regulations, Title 22, Division 4, Chapter 3). Under this regulation, the SDRWQB has developed treatment standards for different beneficial uses through consultation with the California Department of Public Health. The regulation sets out required treatment levels (e.g. tertiary or secondary) required for different uses, such as park irrigation or industrial use (22 CCR 60301-60355).

2.3 Local

2.3.1 San Diego Municipal Separate Storm Sewer System (MS4) Permit

The San Diego Region's MS4 Permit (Order No. R9-2013-001, as amended by Order Nos R9 2015-001 and R9 2015-011) is designed to regulate discharges from municipal separate storm sewer systems. The MS4 Permit covers 39 municipal, county government, and special district entities (referred to jointly as Copermittees) located in San Diego County, southern Orange County, and southwestern Riverside County who own and operate large MS4s, which discharge storm water (wet weather) runoff and non-storm water (dry weather) runoff to surface waters (SDRWCB 2015).

The MS4 Permit includes minimum BMPs required for commercial, industrial, municipal, and residential operations. The Permit also requires inspection of BMPs. Additionally, each development project must implement, where applicable and feasible, low impact development (LID) BMPs to mimic the natural hydrology of the site and retain and/or treat pollutants in storm water runoff prior to discharging to and from the MS4 (SDRWQCB 2015). The San Diego Low Impact Development Design Manual details various LID BMPs and provides guidance on how to select them (CSD 2011).

The County of San Diego BMP Design Manual provides guidance for land development and public improvement projects to comply with the region's MS4 Permit (San Diego County 2017). This manual replaces the County of San Diego Standard Urban Stormwater Mitigation Plan (SUSMP), and is focused on project design requirements and related post-construction requirements.

The MS4 Permit requires the preparation of WQIPs for each watershed management area (WMA). **Table 7** lists the associated hydrologic units (HUs) and hydrologic areas (HAs) that comprise each WMA, and the status of WCIPs for each WMA. The goal of the WQIPs is to guide the Copermittees' jurisdictional runoff management programs towards achieving the outcome of improved water quality in MS4 discharges and receiving waters. WQIPs must identify the highest priority water quality conditions and sources of pollutants or stressors. To identify the water quality priorities within each watershed addressed by their WQIP, the responsible agencies within each WMA considered various factors. These factors included but are not limited to: receiving waters listed as impaired on the Clean Water Act Section 303(d) List, TMDLs adopted and under development by the SDRWQCB, sensitive or highly valued receiving waters, and monitoring data. Following identification of highest priority water quality conditions, water quality improvement goals and strategies must be developed to address these conditions (SDRWQCB, 2015).

TABLE 7
WQIP STATUS BY WMA

Watershed Management Area	Hydrologic Unit(s)	WQIP Status
Santa Margarita River	Santa Margarita (902.00)	In Progress
San Luis Rey River	San Luis Rey (903.00)	Complete
Carlsbad	Carlsbad (904.00)	Complete
San Dieguito River	San Dieguito (905.00)	Complete
Los Peñasquitos	Peñasquitos (906.00)	Complete
Mission Bay	Peñasquitos (906.00)	Complete
San Diego River	San Diego (907.00)	Complete
San Diego Bay	Pueblo San Diego (908.00)	Complete
	Sweetwater (909.00)	Complete
	Otay (910.00)	Complete
Tijuana River	Tijuana (911.00)	Complete

The MS4 Permit requires implementation of the Jurisdictional Runoff Management Programs (JRMPs) in accordance with the strategies identified in the WQIPs. The goal of JRMPs is to effectively prohibit non-storm water discharges to the MS4 and reduce the discharge of pollutants in storm water to the maximum extent possible (SDRWQCB, 2015). A list of entities within the San Diego Region that have developed JRMPs and the corresponding watersheds is provided in **Table 8** below.

TABLE 8
JRMPS WITHIN THE SAN DIEGO REGION

Jurisdiction	Watershed
City of Carlsbad	Carlsbad
City of Chula Vista	San Diego Bay
City of Coronado	San Diego Bay
City of Del Mar	San Dieguito River, Los Peñasquitos
City of El Cajon	San Diego River
City of Encinitas	Carlsbad
City of Escondido	Carlsbad, San Dieguito River
City of Imperial Beach	San Diego Bay, Tijuana River
City of La Mesa	San Diego Bay
City of Lemon Grove	San Diego Bay
City of National City	San Diego Bay
City of Oceanside	San Luis Rey River, Carlsbad
City of Poway	San Dieguito River; Los Peñasquitos
City of San Diego	San Dieguito River; Los Peñasquitos; Mission Bay; San Diego River; San Diego Bay; Tijuana River
City of San Marcos	Carlsbad
City of Santee	San Diego River
City of Solana Beach	Carlsbad; San Dieguito River
City of Vista	San Luis Rey River; Carlsbad
County of San Diego	All
San Diego County Regional Airport Authority	San Diego Bay
San Diego Unified Port District	San Diego Bay

SOURCE: PCW, 2016

2.3.2 Water Quality Control Plan for the San Diego Basin

The nine regional water quality control boards within the state are responsible for adoption and implementation of basin plans, issuance of waste discharge requirements, and performing other functions concerning water quality control within their respective regions, subject to SWRCB review or approval (SDRWQCB 2012). The Water Quality Control Plan for the San Diego Basin (Basin Plan) designates beneficial uses for water bodies in the San Diego Region, and establishes water quality objectives and implementation plans to protect those beneficial uses. The Basin Plan is the Regional Board's plan for achieving the balance between competing uses of surface and ground waters in the San Diego Region.

2.3.3 County of San Diego Jurisdictional Runoff Management Program

The County's 2015 Jurisdictional Runoff Management Program (JRMP) was prepared in compliance with the San Diego Regional Water Quality Control Board MS4 Permit. The purpose of the JRMP is to present programs and strategies to reduce the discharge of pollutants from the MS4 and receiving waters to the maximum extent practicable. The 2015 JRMP replaces the County's former 2013 JRMP, and includes more stringent structural

BMPs for new and redevelopment areas, increased frequency and location for dry weather outfall monitoring, and integration of the JRMP with the strategies identified in the Water Quality Improvement Plans.

2.3.4 County of San Diego Watershed Protection, Stormwater Management, and Discharge Control Ordinance

On January 27, 2016 the County Board of Supervisor's adopted the Watershed Protection, Stormwater Management, and Discharge Control Ordinance (WPO). The purpose of the WPO is to protect the health, safety and general welfare of the County of San Diego residents, to protect water resources and to improve water quality, to cause the use of management practices by the County and its citizens that will reduce the adverse effects of polluted runoff discharges on waters of the state, to secure benefits from the use of stormwater as a resource, and to ensure the County is compliant with applicable state and federal law. The WPO contains discharge prohibitions, and requirements that vary depending on type of land use activity and location in the County. The Stormwater Standards Manual (SSM) is Appendix A of the WPO and sets out in more detail, by project category, what dischargers must do to comply with the WPO and to receive permits for projects and activities that are subject to the WPO. The WPO and SSM define the requirements that are legally enforceable by the County in the unincorporated area of San Diego County.

2.3.5 San Diego County Groundwater Ordinance

The County currently manages anticipated future groundwater demand through the County Groundwater Ordinance. The Ordinance ensures that development will not occur in groundwater-dependent areas of the County unless adequate groundwater supplies are available to serve both existing uses within the affected groundwater basin and the proposed uses. This Ordinance does not limit the number of wells or the amount of groundwater extraction of existing landowners. However, the Ordinance does identify specific measures to mitigate potential groundwater impacts of projects requiring specified discretionary permits. Existing land uses are not subject to the Ordinance unless a listed discretionary permit is required. Additionally, Major Use Permits (MUPs) or MUP Modifications that involve construction of agricultural and ranch support facilities or those involving new or expanded agricultural land uses are among the exemptions from the Ordinance. However, the agricultural exemption does not supersede or limit the application of any law or regulation including CEQA. The Groundwater Ordinance separates the County into three areas of regulations, Borrego Valley (Section 67.720), Groundwater Impacted Basins (Section 67.721), and All Other Projects (Section 67.722).

2.3.6 San Diego County Zoning Ordinance

The Zoning Ordinance was adopted by the Board of Supervisors to regulate land uses in the unincorporated portions of the County of San Diego. Part Four of the Zoning Ordinance includes development regulations to specify the nature, components, and use of development regulations and to establish regulations regarding the physical character and intensity of development. The County's development regulations include, but are not limited to, maximum density, permitted building types, height regulations, minimum lot coverage, and minimum setbacks requirements. Setback Regulations, Section 4800 through Section 4899, establish minimum front, side, and rear setback requirements for all buildings and other structures within San Diego County in order to assure light, air, privacy, and open areas appropriate to the use, location, and impact of uses and structures.

2.3.7 San Diego Basin Study

The San Diego Basin Study (distinct from the Basin Plan in Section 2.3.2) was prepared by the US Bureau of Reclamation for the San Diego Public Utilities Department. The document aims to determine potential climate change impacts on the region's water supplies and demands, and to identify potential adaptation strategies. The report quantifies an increasing need for potable water, which could be partially satisfied by using captured stormwater to satisfy less quality-critical needs (Reclamation 2017).

3. Summary of Existing Plans and Studies in the San Diego Region

3.1 Urban Water Management Plans

Aiming to prevent supply disruptions, encourage long term planning and promote water conservation, the State of California established the Urban Water Management Planning Act of 1983, later amended by the Water Conservation Act of 2009 (SB X7-7). Administered by the California Department of Water Resources (DWR), water suppliers are required to develop an Urban Water Management Plan (UWMP) and update their plan on a five-year cycle. The UWMPs within the greater San Diego region and their status are listed within **Table 9** below. Not only are UWMPs developed to meet regulatory requirements, but they also serve as an overarching water resources planning document for a water district's residents, businesses, interest groups, and public officials. The UWMPs generally provide information on a water district's current and future water demands and supplies, water resources challenges, and summarize the major water resources initiatives proactively taken to ensure a safe, reliable water supply for its customers.

3.2 Integrated Regional Water Management Plan

Integrated Regional Water Management (IRWM) Plans are collaborative efforts to identify and implement water management solutions on a regional scale that increase regional self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives (DWR 2017a). IRWM enables self-identified regions to integrate and implement water management solutions for their region, which is a foundation of the California Water Action Plan. IRWM crosses jurisdictional, watershed, and political boundaries; involves multiple agencies, stakeholders, individuals, and groups; and attempts to address the issues and differing perspectives of all the entities involved through mutually beneficial solutions. The IRWM Plan for the San Diego Region was updated in 2013, and presents an overarching assessment of the San Diego region's water supply, water quality and ecosystem challenges and provides recommendations for sustainable answers. The SCFS will be incorporated into the next IRWM Plan update.

3.3 Integrated Resource Plans

Through Senate Bill 350, publicly owned utilities (POUs) with an average load greater than 700 GWh (in the 2013-2016 period) are require to adopt Integrated Resource Plans (IRPs) by January 1, 2019, submit them to the Energy Commission, and update them at least once every five years (CEC 2017). IRPs are electricity system planning documents intended to ensure that POUs lay out the resource needs, policy goals, physical and operational constraints, and general policies or proposed resource choices of an electric utility, including customer-preferred resources. These plans provide a framework to evaluate how utilities have chosen to align with greenhouse gas emission reduction targets as well as energy and other policy goals. These other goals include reductions of electricity sector greenhouse gas emissions of 40 percent from 1990 levels by 2030; a Renewable Portfolio Standard of 50 percent by 2030; and energy efficiency, gas use efficiency, and vehicle electrification targets.

TABLE 9
URBAN WATER MANAGEMENT PLANS WITHIN THE SAN DIEGO REGION

Water Supplier Name	Date Submitted	Reviewed by DWR
Helix Water District	5/31/2016	Under Review
Lakeside Water District	6/28/2016	Under Review
City of San Diego	7/01/2016	Under Review
Carlsbad Municipal Water District	6/27/2016	Under Review
City of Escondido	6/28/2016	No
San Diego County Water Authority	6/28/2016	Yes
Sweetwater Authority	6/27/2016	No
Fallbrook Public Utilities District	6/30/2016	Under Review
Vallecitos Water District	6/27/2016	No
Otay Water District	6/28/2016	Under Review
Padre Dam Municipal Water District	6/30/2016	Yes
City of Poway	6/22/2016	No
Rainbow Municipal Water District	7/01/2016	No
Rincon Del Diablo Water District	6/30/2016	No
Santa Fe Irrigation District	6/02/2016	Under Review
San Dieguito Water District	6/30/2016	No
Valley Center Municipal Water District	7/01/2016	Yes
Vista Irrigation District	7/20/2016	No

WUEdata 2017

3.4 Watershed Management Plans

The County of San Diego's Santa Margarita River Watershed Management Plan (SMRWMP) was adopted in 2005. The SMRWMP's vision is to protect, sustain, and restore the quality and beneficial uses of water, land, habitats, and other natural resources of the Santa Margarita River Watershed. The SMRWMP is a guide for stakeholders to continue watershed planning efforts, and is intended to be updated periodically to include new research and findings, to revise land use plans as they are adopted, and to modify the actions recommended for action. Goals of the plan include, but are not limited to: promote interagency coordination, organizational efficiency and consistency by coordinating research, planning, and monitoring efforts; promote community awareness of, and interest and participation in, stewardship of the natural, cultural, recreational, agricultural, water, and open space resources of the watershed; and balance public and individual landowner interests with resource protection goals.

3.5 Groundwater Management Plans/ Basin Information Sheets

In September 2014, the Sustainable Groundwater Management Act (SGMA) was signed, allowing local agencies to customize groundwater sustainability plans. The SGMA is a three-bill legislative package, composed of AB 1739, SB 1168, and SB 1319. The SGMA empowers local agencies to adopt groundwater management plans that are tailored to the resources and needs of their communities (DWR 2017b). The San Pasqual Basin Groundwater Management Plan (SPGMP) was adopted by the City of San Diego in November of 2007. The goal of the SPGMP is to understand and enhance the long-term sustainability and quality of groundwater within the basin, and protect groundwater resources for beneficial uses including water supply, agriculture, and the environment.

Each groundwater basin within California has a Basin Information Sheet. There are 22 groundwater basins within the South Coast Hydrologic Region, including but not limited to Batiquitos Lagoon Valley Groundwater Basin, Campo Valley Groundwater Basin, San Diego River Valley Groundwater Basin, and Otay Valley Groundwater Basin. Basin Information Sheets consist of the basin's boundaries, hydrogeologic information, well characteristics, active monitoring data, and basin management.

3.6 Stormwater Resource Plan

SB 985 authorizes a city, county, or special district to develop a Stormwater Resource Plan (SWRP) as an eligibility requirement for an entity to receive grant funding for a storm water and/or urban runoff project. Stormwater resource plans list and prioritize projects geared toward capturing stormwater for underground storage, thus increasing local groundwater supplies and reducing the need to purchase imported water. The San Diego Regional SWRP was published in March 2017. The SWRP uses existing watershed and regional plans that identify opportunities, strategies, and priority conditions and goals for water quality, water resources, flood management, community, and natural resource benefits within the San Diego region. The primary purpose of the SWRP is to provide tools and guidance to support the San Diego Region in developing more competitive projects for the SWRCB's Storm Water Grant Program. Furthermore, SWRPs are required for storm water and dry weather capture projects to obtain grant funds through all chapters of Proposition 1; therefore, this plan will also allow projects within the region to maintain their eligibility for future grant funding opportunities.

3.7 Land Use or Comprehensive Plan Updates

The San Diego Association of Governments (SANDAG) is a public agency made up of 18 cities and county governments, which serves as the forum for regional decision-making. SANDAG's Regional Comprehensive Plan (RCP) serves as the long-term planning framework for the San Diego Region. The RCP integrates local land use and transportation decisions, and focuses attention on where and how the region should grow. The RCP contains an incentive-based approach to encourage and channel growth into existing and future urban areas and smart growth communities. In 2015, San Diego Forward: The Regional Plan was adopted by the SANDAG Board of Directors, which combines the RCOP with the 2050 Regional Transportation Plan and Sustainable Communities Strategy.

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ATTACHMENT A

Data Needs List, Status, and Steps Forward

Data Needs	Data Files/Plans/Reports Needed	Scale of Data Request	Additional Details/Notes	List of Sources Obtained (on Project FTP)	Data to be Researched or Assumptions to Develop Concepts
Flood Control Infrastructure					
Stormwater Conveyance and Storage Infrastructure not included in MS4 GIS Data Files	• GIS data files showing location and size of culverts, channels, flood basins and any other flood control infrastructure not included in the GIS MS4 layers (typically conveyance and storage beyond MS4 outfalls).	• Jurisdictions Needed: Imperial Beach; Chula Vista; National City; Coronado; Lemon Grove; La Mesa; El Cajon; Santee; Poway; Escondido; Del Mar; Solana Beach; Encinitas; San Marcos; Carlsbad; Oceanside; Vista	• In addition to sending GIS files also provide information as shape files or data file on the jurisdictions of the property (i.e. Is it provide with a maintenance easement, under USACE management) • Data from local rain gages also mentioned in TAC meeting as data source for local precipitation data	• Stormdrain networks and stormdrain outfalls in much of San Diego County • Rain gauge data available from online NOAA at locations across the county (174)	• Contact jurisdictions and request information on conveyance and storage infrastructure
Groundwater					
Within Designated Groundwater Basins (see map), existing or planned extraction well systems	• Locations and depth of existing or planned extraction wells and yield within designated groundwater basins (see map) • GIS data on the location of the wells • Data sheet or metadata on the depth of existing wells, depth of groundwater and average annual yield	• Designated groundwater basins	• Any studies or information on augmenting the groundwater basins with additional runoff infiltration and capacity of system to extract and use additional yield • Studies on the potential for groundwater contamination from stormwater infiltration that should be considered	• USGS https://water.usgs.gov/ogw/data.html#level • SWRCB GeoTracker Groundwater Ambient Monitoring and Assessment Program (GAMA) http://geotracker.waterboards.ca.gov/gama/gamamap/public/default.asp?CMD=runreport&myaddress=San+Diego • Soil Agricultural Groundwater Banking Index (SAGBI) https://casoilresource.lawr.ucdavis.edu/sagbi/ • CDWR California Statewide Groundwater Elevation Monitoring (CASGEM)	• USGS National Water Information System (NWIS) will determine location, water quality, annual yield and depth of active wells • GeoTracker GAMA provides groundwater well locations and chemical data of wells (DWR, GAMA, Irrigated Lands Program, Water Board, Public, NWIS) along with elevation/depth to groundwater of wells (Environmental Monitoring Wells, DWR) over the past 10 years • Soil profile data from SAGBI will assist in the determination of infiltration rates through groundwater recharge data • CASGEM provides GIS layers for groundwater basins and elevations

Data Needs	Data Files/Plans/Reports Needed	Scale of Data Request	Additional Details/Notes	List of Sources Obtained (on Project FTP)	Data to be Researched or Assumptions to Develop Concepts
				http://www.water.ca.gov/groundwater/casgem/	
Water table levels within designated groundwater basis	• Data from well or USGS data maps on the depth to groundwater within designated basins • Excel Spreadsheet of list of groundwater well depth to groundwater based on ground elevation and elevation of groundwater table; or contour map as GIS file including well location	• Designated groundwater basins • Average level for wells from this year, or average of least 10 years, preferable. • Average levels from a historical wet year are a good alternative if the previous is not available.	• If well data not readily available, then groundwater contour map or other data file that shows groundwater levels on the average are 10 ft or greater below ground surface within basin	• USGS https://water.usgs.gov/ogw/data.html#level • SWRCB GeoTracker Groundwater Ambient Monitoring and Assessment Program (GAMA) http://geotracker.waterboards.ca.gov/gama/gamamap/public/default.asp?CMD=runreport&myaddress=San+Diego	• USGS National Water Information System (NWIS) will determine location, water quality and depth of active wells • GeoTracker GAMA provides groundwater well locations and chemical data of wells (DWR, GAMA, Irrigated Lands Program, Water Board, Public, NWIS) along with elevation/depth to groundwater (Environmental Monitoring Wells, DWR) over the past 10 years
Irrigation					
Irrigation Use at parks, recreational facilities and landscaped areas in roadway right of ways	• Spreadsheet of monthly average irrigation rates in flow per acre on an average daily cycle	• If data are available, provide the description of the park, recreation facility, or landscape right of way and the location on GIS map and total acres • Selected sights may be provided that cover 2, 5 10 and greater than 20 acre sites. This will provide sufficient representation	• Identify if the irrigation is from recycled or potable water source • Identify if the irrigation is above ground pressure spray or below ground drip • Identify if interest in augmenting irrigation with a stormwater if treated and provided when needed	• Information from San Diego Parks & Rec regarding drought and general conservation practices • Regional evapotranspiration and plant irrigation need estimates from SWRP	• Park and facility size (from park and facility managers, or inferred from map) • Irrigation information from park and facility managers • Where no irrigation information provided, assume average irrigation for turf grass over the course of a year (estimates from SWRP)
Sanitary Sewer – Augment Dry Weather Flows and Local Water Supply					
List of wastewater treatment plants in SD County	• Total Plant Capacity (MGD) • Description of plant processes and capacity of processes • Average daily Influent Flow Rates during wet weather (MGD) • Average daily Influent Flow Rates during dry weather (MGD) • Recycled water production rates (dry/wet)	• SD County wastewater treatment plants and available operational data	• These data will be used to assess the potential of beneficial use of stormwater for augmenting low flow for solids management and augmenting local water supplies with controlled stormwater flow and quality for indirect potable and/or recycled water uses.	• Currently seeking permission from relevant clients to put up their data on the ftp for this study	• Assuming stormwater storage capacity will be evaluated after appropriate candidate plant(s) and sewershed(s) has/have been identified and evaluated under Task 2

Data Needs	Data Files/Plans/Reports Needed	Scale of Data Request	Additional Details/Notes	List of Sources Obtained (on Project FTP)	Data to be Researched or Assumptions to Develop Concepts
	• Potable reuse production rates (dry/wet)		• Data on projection of population growth and anticipated reduction in sanitary sewer plant capacity in the future		
Sanitary sewer main lines	• GIS shapefile (Only considering pipes >= 36-inches) • Meta Data/Data Sheets on: • Invert elevations • Total pipe capacity (cfs/gpm) • Average/representative daily peak flow rates during dry weather (cfs/gpm) • Average/representative daily peak flow rates during wet weather (cfs/gpm) • SSO history	• Jurisdictions within San Diego County • Only considering pipes >= 36-inches (GIS shapefile)	• Data on projection of population growth and anticipated reduction in sanitary sewer lines capacity in the future	• No data currently uploaded to FTP	• Assuming sewershed specific data can be requested at a higher resolution once candidate treatment plant(s) has/have been identified and evaluated under Task 2
Example Projects - Concept and Design Plans*					
NOTE	**Projects and concept plans can be provided confidentially to this study. They will be used as the basis for general quantification of stormwater capture and beneficial use options in the County similar to the provided projects and concept plans, but the plans themselves will not be released.* ***Please indicate if project is confidential or can be included in this study and/or as a project that is listed or would like to be listed in the Stormwater Resource Plan and updated IRMP for eligibility for Prop 1 funding.***	• PDF of plans and drawing and project description that includes, where available, stormwater capture volume, treatment type and rate (flow) treated, and volume and rate of stormwater and/or dry weather flow beneficially used	• Concept can also include just storage of stormwater with future plans for re-use – volume (capacity) of storage unit needed (see first item below) • Concept can also be from pending or submitted grant application		
Stormwater Storage Example Projects	• Existing or planned stormwater capture and storage project – PDF of plans and drawing with project description	• Underground vaults • Surface ponds and retention/ infiltration basins • Other stormwater capture and storage facilities or systems	• Additional information on capacity of storage, infiltration rates (if applicable), release rates, and any planned or desired beneficial use of stormwater captured	• Discussed in WQIPs	• Based on locations identified through research above, request plans and drawings for specific storage facilities
Planned new or expansion of parks, recreation facilities, landscaped areas within right of ways that require irrigation	• PDF of plans and drawing with project description of planned new and expansions that includes area of landscaped areas, landscape type and planned irrigation system and demand	• Planned new or expansion of parks, open space, recreational areas, right of ways, green street that will require year round irrigation	• If available, include in project description irrigation plans and requirements on an average monthly basis.	• Discussed in WQIPs (e.g. Mission Bay)	• Request plans from parks and recreational facilities (in addition to irrigation practices)

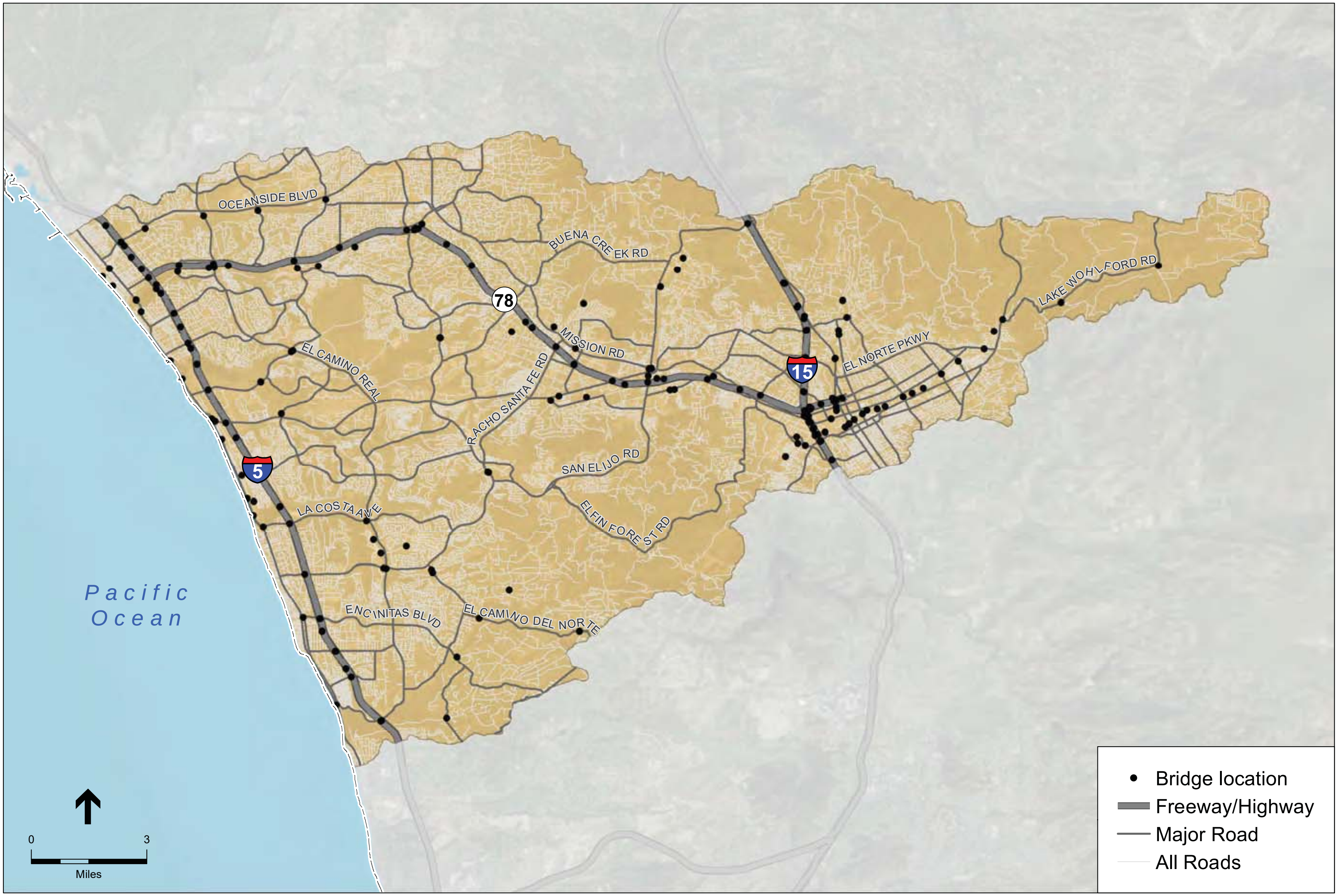
Data Needs	Data Files/Plans/Reports Needed	Scale of Data Request	Additional Details/Notes	List of Sources Obtained (on Project FTP)	Data to be Researched or Assumptions to Develop Concepts
		• Planned facilities that could use stormwater for some portion of their irrigation needs and/or supplement toilet use (gray water)	• This is in addition to the information requested on irrigation demand and opportunities listed above under "irrigation"		
Wetland treatment systems and Natural Treatment Systems that provide water quality, flood management and habitat benefit	• PDF of plans and drawing with project description that includes that includes size of wetlands, potential to store additional stormwater, location of storm sewer system and plant palate	• Existing or planned facilities that could use additional stored stormwater and/or dry-weather flows for irrigation and/or maintain vegetation in treatment wetland system	• If available, include in project description irrigation plans and requirements on an average monthly basis. • Provide, if available, dry weather flow data from nearby storm sewer • Studies/data of historic minimal flows should be considered where data are available	• Discussed in WQIP (e.g. San Diego River)	• Contact WMAs for details on the existing or planned systems referenced in the WQIP
BMPs and green infrastructure with infiltration that require irrigation and/or have infiltration to groundwater	• PDF of plans and drawing and project description of existing or planned BMPs and green infrastructure. • Description to include size of BMP, stormwater storage volume capacity, estimated infiltration (where applicable) and irrigation plans and demand	• BMPs and green infrastructure providing infiltration outside designated groundwater basin • BMPs and green infrastructure that will have year round irrigation needs	• If available, include in project description irrigation plans and requirements on an average monthly basis. • Provide, if available, dry weather flow data from nearby storm sewer	• Discussed in WQIP	•
Storage and beneficial use on private property	• PDF of plans and drawing and project description of existing or planned BMPs, green infrastructure and stormwater storage. • Description to include location, size of BMP, stormwater storage volume capacity, estimated infiltration (where applicable) and any plans or potential for beneficial use of stormwater and/or dry weather flows	• If project is a potential opportunity – project description is acceptable • Description needs to include anticipated volume of stormwater and/or dry weather flows captured • Projects that have a need for stormwater are also welcome •	• These will be used as examples and potential projects and not used for regional quantification	• Stone Brewery and World Bistro & Gardens in Escondido	• Research additional private beneficial use projects within SD County, including locations (GIS) • If only the Stone Garden is available, assume this is representative for other private landscaping and infiltration systems
Other Relevant Reports and Studies					
Beneficial use of stormwater	• Reports or studies detailing capture and beneficial use methods	• Should be limited to Southern California	• Study and program in Santa Monica was mentioned at TAC • Caltrans report on stormwater management in landscaped area and right of ways was also mentioned at TAC meeting	• Santa Monica Urban Runoff Recycling Facility (SMURRF) info sheet and supporting reports (Boyle Engineering) • Caltrans Statewide Stormwater Management Plan	•

Data Needs	Data Files/Plans/Reports Needed	Scale of Data Request	Additional Details/Notes	List of Sources Obtained (on Project FTP)	Data to be Researched or Assumptions to Develop Concepts
				• Green Infrastructure for Los Angeles report	
Augmentation of groundwater supplies	• Plans or reports on existing or planned practices using stormwater to augment groundwater supplies	• Designated groundwater basins		• Santa Margarita River Conjunctive Use Enhancement Program • City of San Diego Priority Basin Project http://www.waterboards.ca.gov/gama/publications.shtml • City of San Diego Basin Infrastructure Study https://groksurf.files.wordpress.com/2013/07/city-of-san-diego-basin-study-proposal-final-2.pdf • San Diego County Water Authority – SGMA http://www.sandiegocounty.gov/content/sdc/pds/SGMA.html#par_content	• Groundwater storage and reuse project • The Priority Basin Project designates critical basins for the state's water needs • Discusses the implementation of San Diego's Integrated Water Resources Management (IWRM) program, including stormwater SGMA requires basins most critical to the state's water needs to be sustainably managed by local public agencies (e.g., counties, cities, and water agencies) who become groundwater sustainability agencies, or GSAs.
Restoration of natural hydrology	• Projects or plans restoring streams, creeks, or other natural systems • GIS data files of identified restoration sites and associated stormwater management – include parcel ownership and shape file of easements	• Report and studies within San Diego County • Preferably projects/plans that include promoting storage and infiltration of stormwater to restore natural hydrology • Studies on base flows needed to maintain biological health	• Chollas Creek restoration planning report was mentioned at TAC • Studies/data of historic minimal flows should be considered where data are available	• Chollas Creek Enhancement Program (2002)	• Research creek/stream restoration projects within SD County, including locations (GIS) • If only Chollas is available, assume this is representative for other creeks/streams located by map
Available stormwater storage potential	• Reports on existing stormwater storage potential • This likely overlaps with Flood Control Infrastructure (above) and information in the MS4 permit.	• Report and studies within San Diego County • Flood management plans and report	• Coordination/cooperation with USACE mentioned at TAC meeting • Studies by Caltrans mentioned at TAC meeting, required to treat and store large volumes	• Discussed in WQIP • MS4 GIS data	• Augment with results of search for stormwater and flood storage infrastructure (above) • City flood management plans

Data Needs	Data Files/Plans/Reports Needed	Scale of Data Request	Additional Details/Notes	List of Sources Obtained (on Project FTP)	Data to be Researched or Assumptions to Develop Concepts
			• Watershed Management Assessment was referenced at TAC meeting		
Storage and beneficial use on private property	• Locations of properties • Methods applied (collection, storage, treatment, end-use) • Water quality improvement	• Report and studies within San Diego County		• Limited current data	• Review rain barrel systems and programs that encourage them
Similar Stormwater Capture and Beneficial Use studies in different regions	• Stormwater capture feasibility studies performed for smaller regions within the county or for other large regions that could be used to support, augment, or guide this study.	• Southern California	• Study done for City of Santa Monica mentioned at TAC meeting	• San Diego River Valley Storm Water Capture Concepts (2017) • LA Stormwater Capture Master Plan (2015) • NRDC https://www.nrdc.org/issues/encourage-green-infrastructure • City of Santa Monica Urban Runoff Management Program https://cfpub.epa.gov/npstbx/files/santamonica_urbrochure.pdf Related Santa Monica Projects https://www.smgov.net/Departments/OSE/Categories/Urban_Runoff/Case_Studies.aspx	• NRDC is a source of funding and guidance for sustainable storm water management • A program which suggests BMPs and development design ideas and solutions for mitigating runoff

ATTACHMENT B

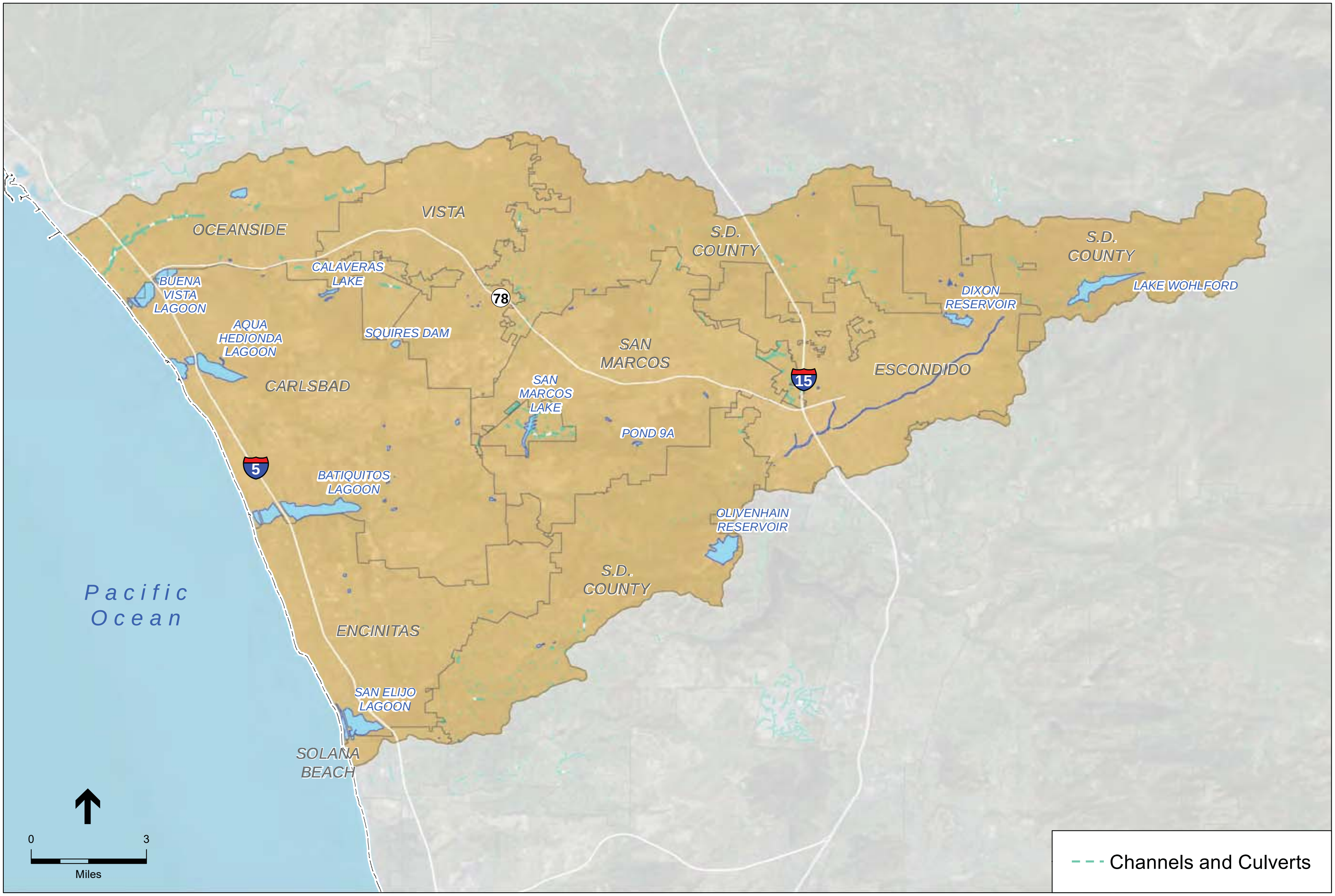
Existing Conditions Figures by WMA



SOURCE: ESRI; SanGIS 2017; Caltrans 2015

SWRP . 160618

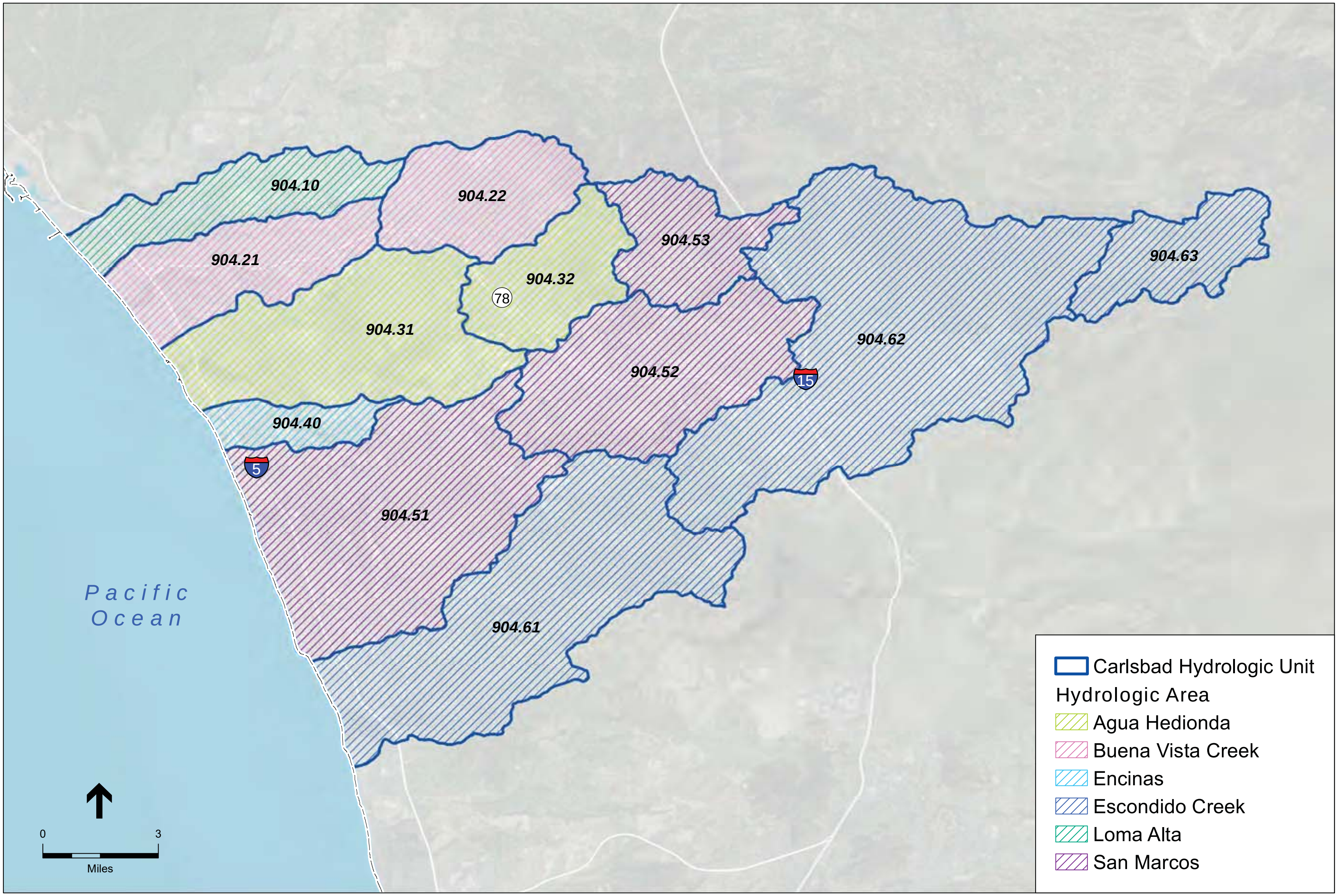
Figure B-1
Built Environments within the Carlsbad Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016; City of Oceanside, 2016; City of Solana Beach, 2016

SCFS . 160618

Figure B-2
Flood Control System within the Carlsbad Water Management Area

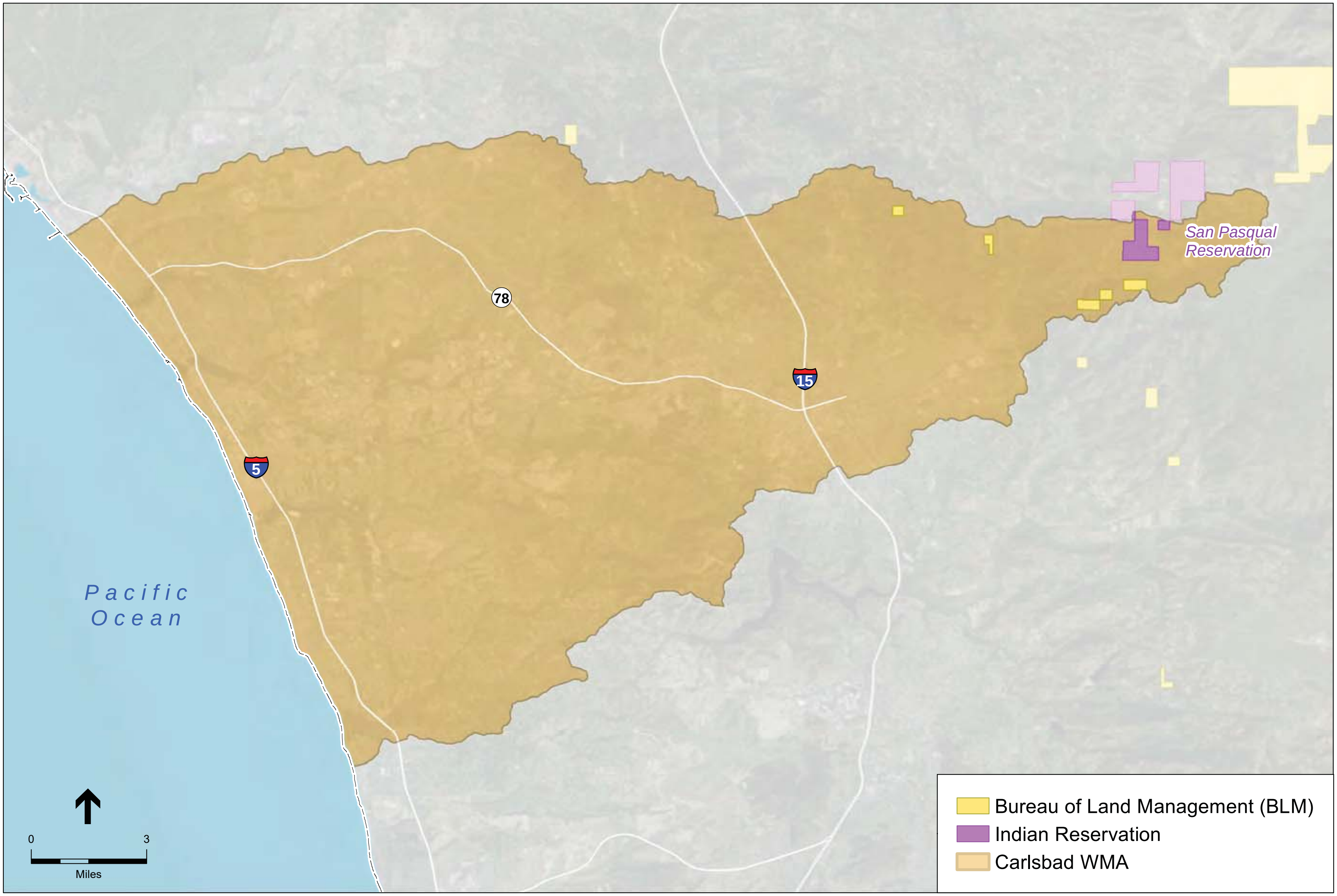


SOURCE: ESRI, 2016; SanGIS, 2016

SWRP . 160618

Figure **B-3**

Hydrologic Units and Area within the Carlsbad Water Management Area

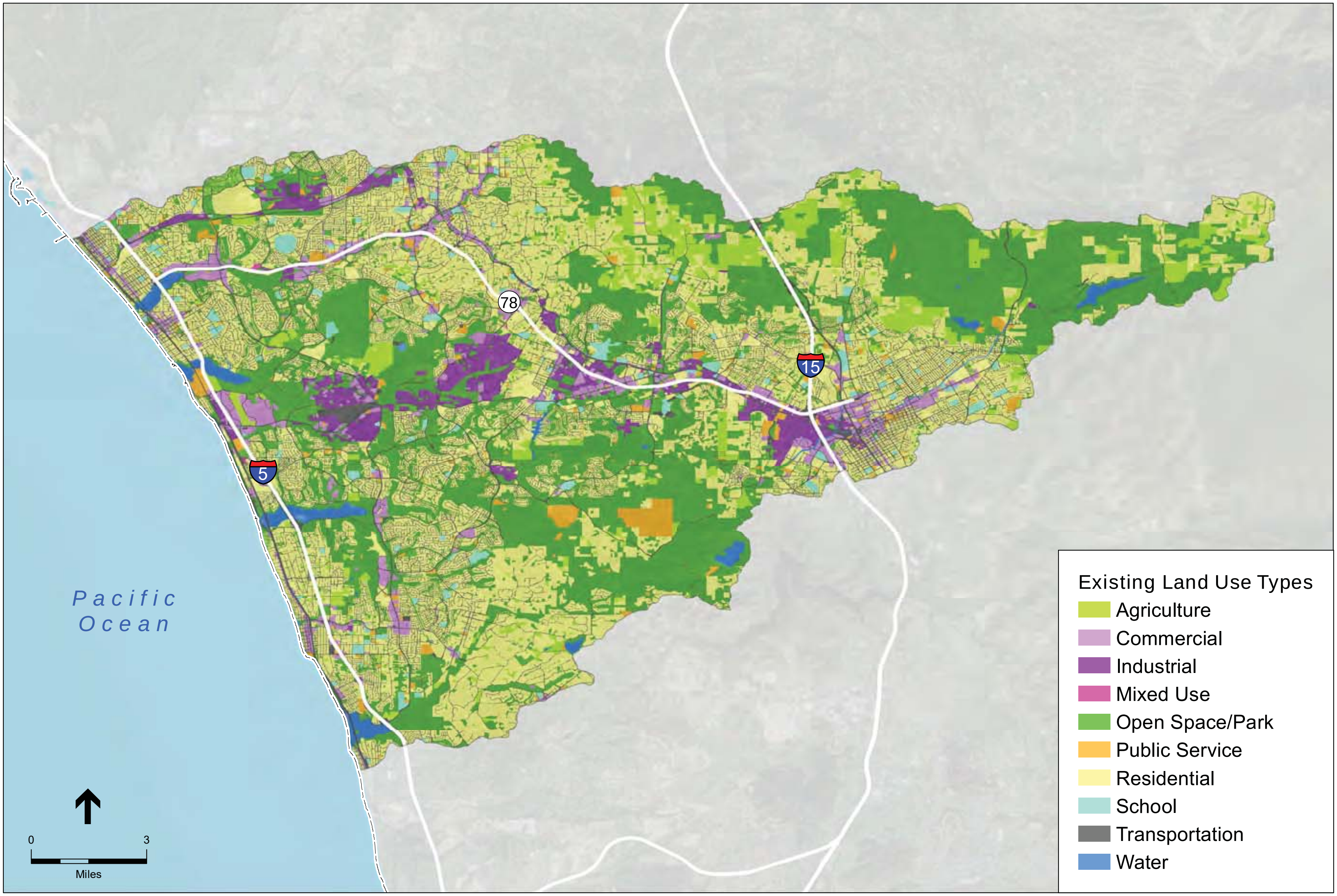


SOURCE: ESRI, 2016; SanGIS, 2016; USGS 2017

SCFS . 160618

Figure B-4

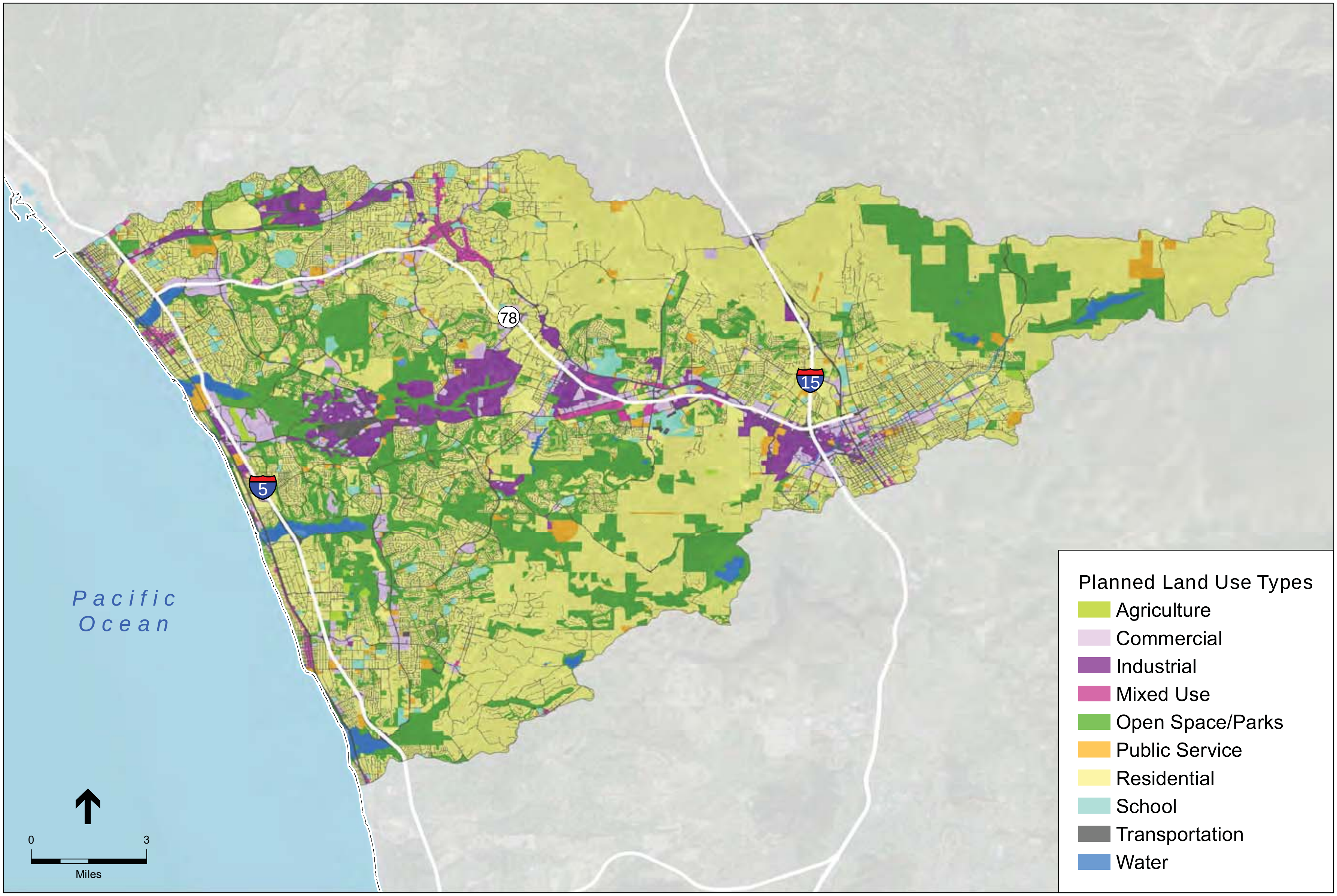
Land Use Agencies within the Carlsbad Water Management Area



SOURCE: ESRI; SanGIS, 2017

SCFS . 140075.20

Figure **B-5**
Existing Land Use within the Carlsbad Water Management Area

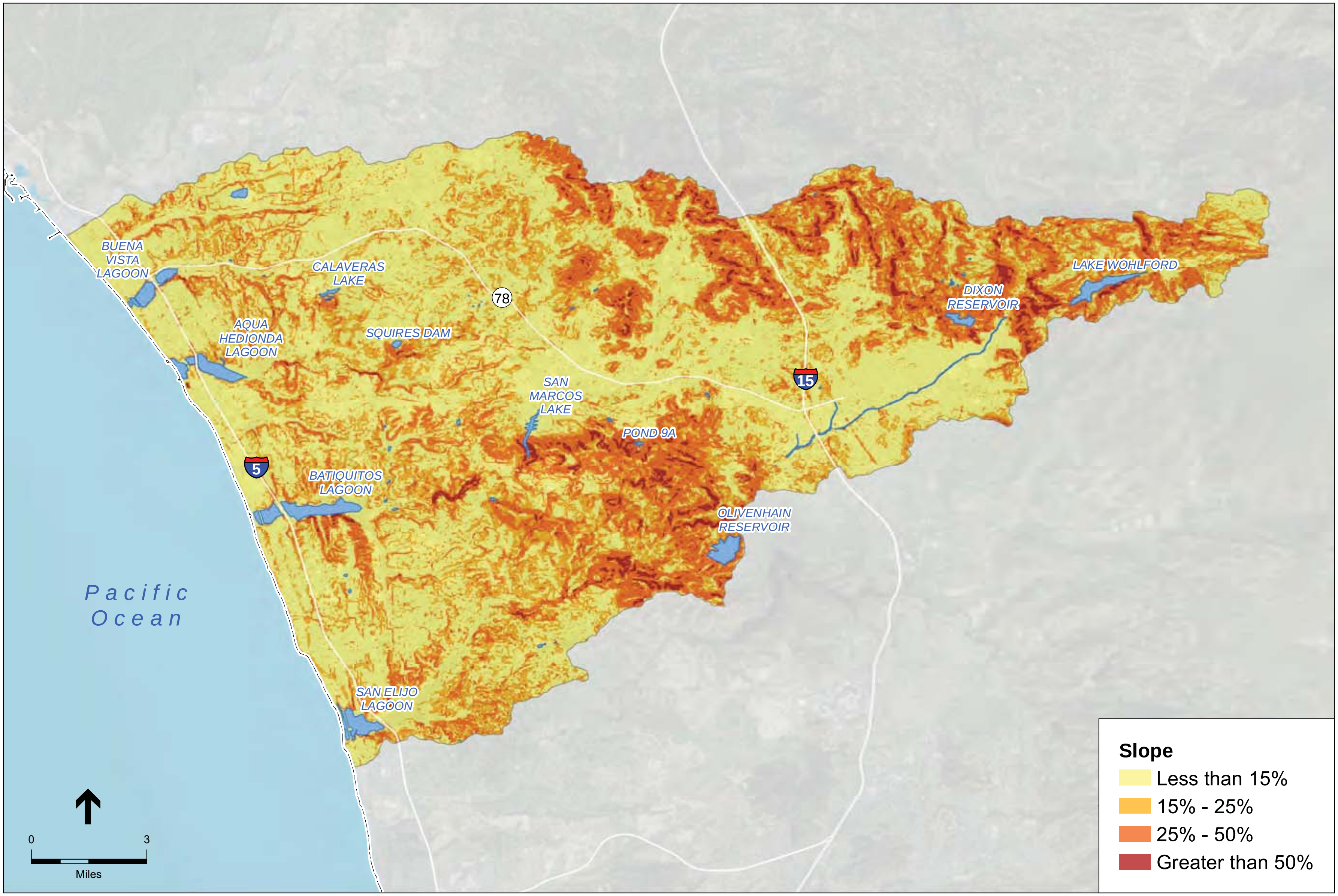


SOURCE: ESRI; SanGIS, 2017

SCFS . 140075.20

Figure **B-6**

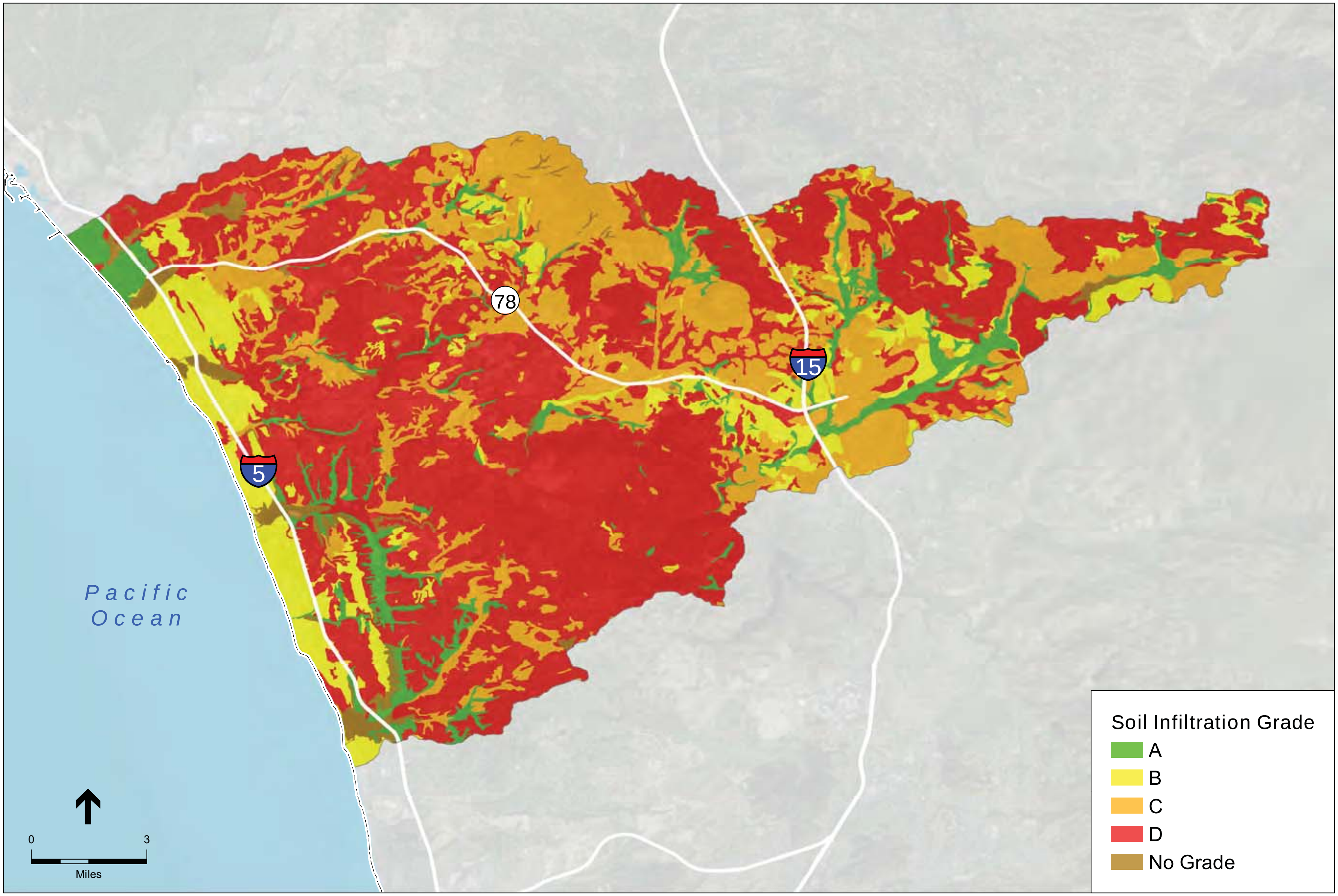
Planned Land Use within the Carlsbad Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 160618

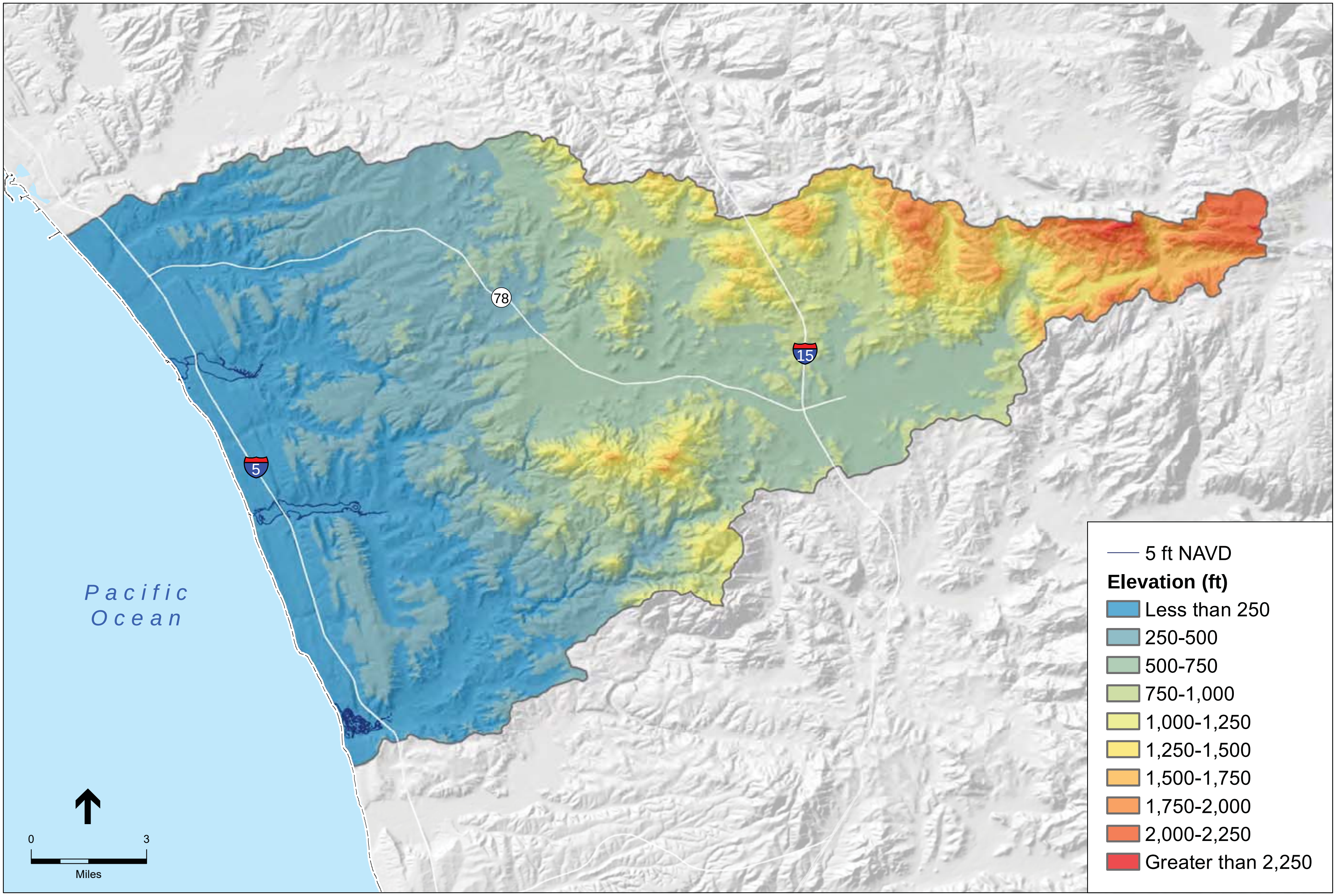
Figure B-7
Slope within the Carlsbad Water Management Area



SOURCE: ESRI, 2016; USDA

SCFS . 140075.20

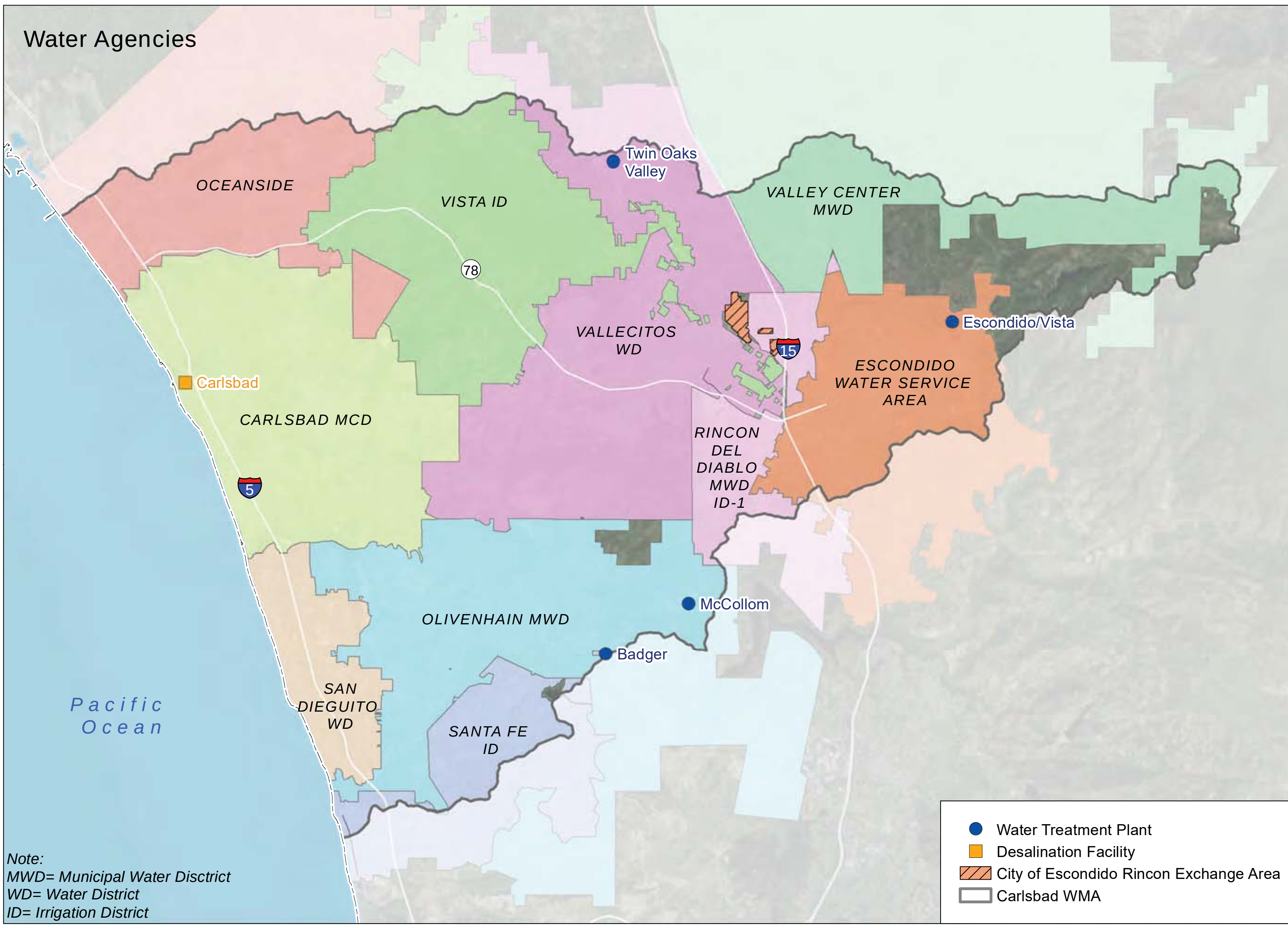
Figure **B-8**
Soil Types within the Carlsbad Water Management Area

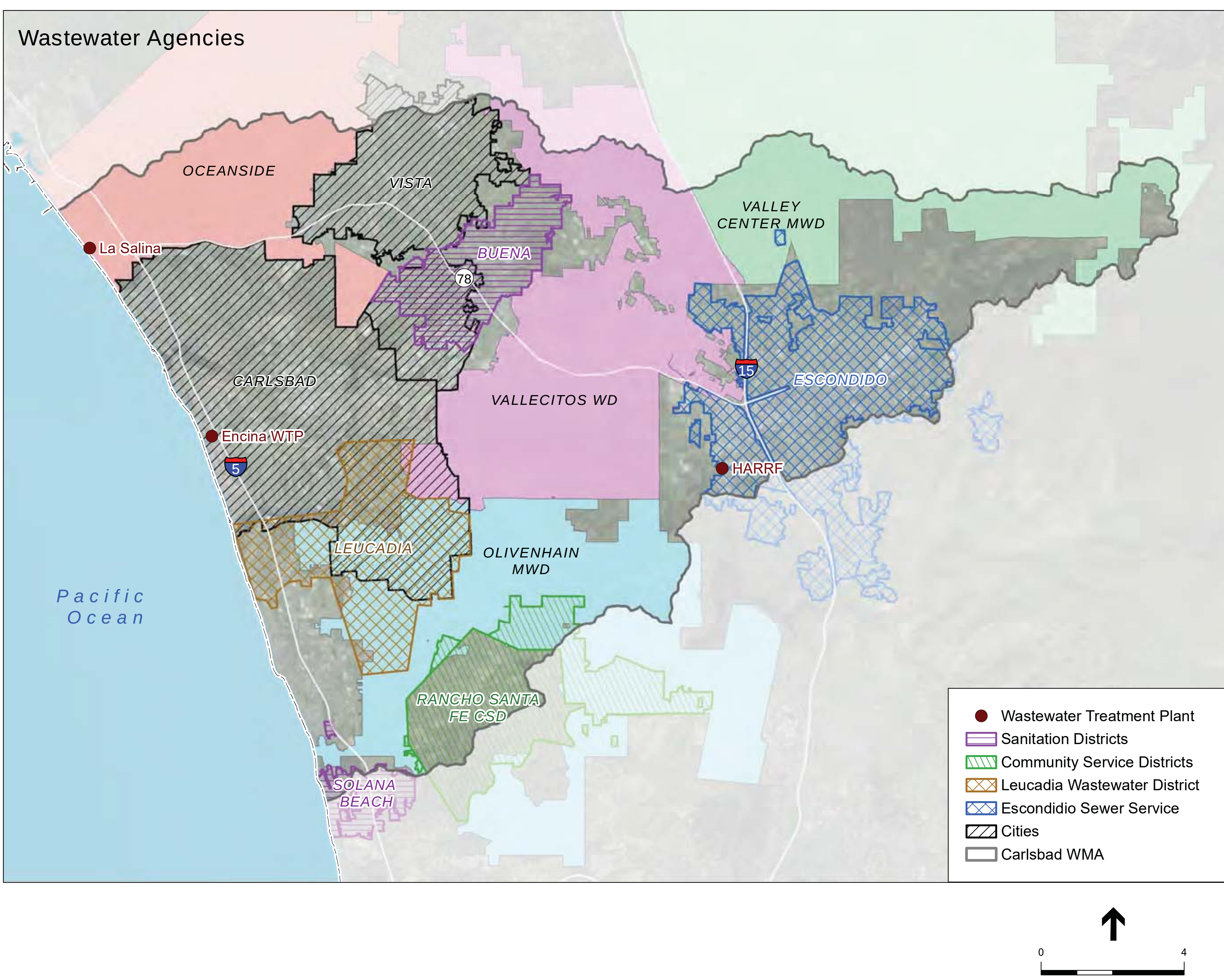


SOURCE: ESRI, 2016; SanGIS, 2016; USGS 2017

SCFS . 140075.20

Figure **B-9**
Topography within the Carlsbad Water Management Area

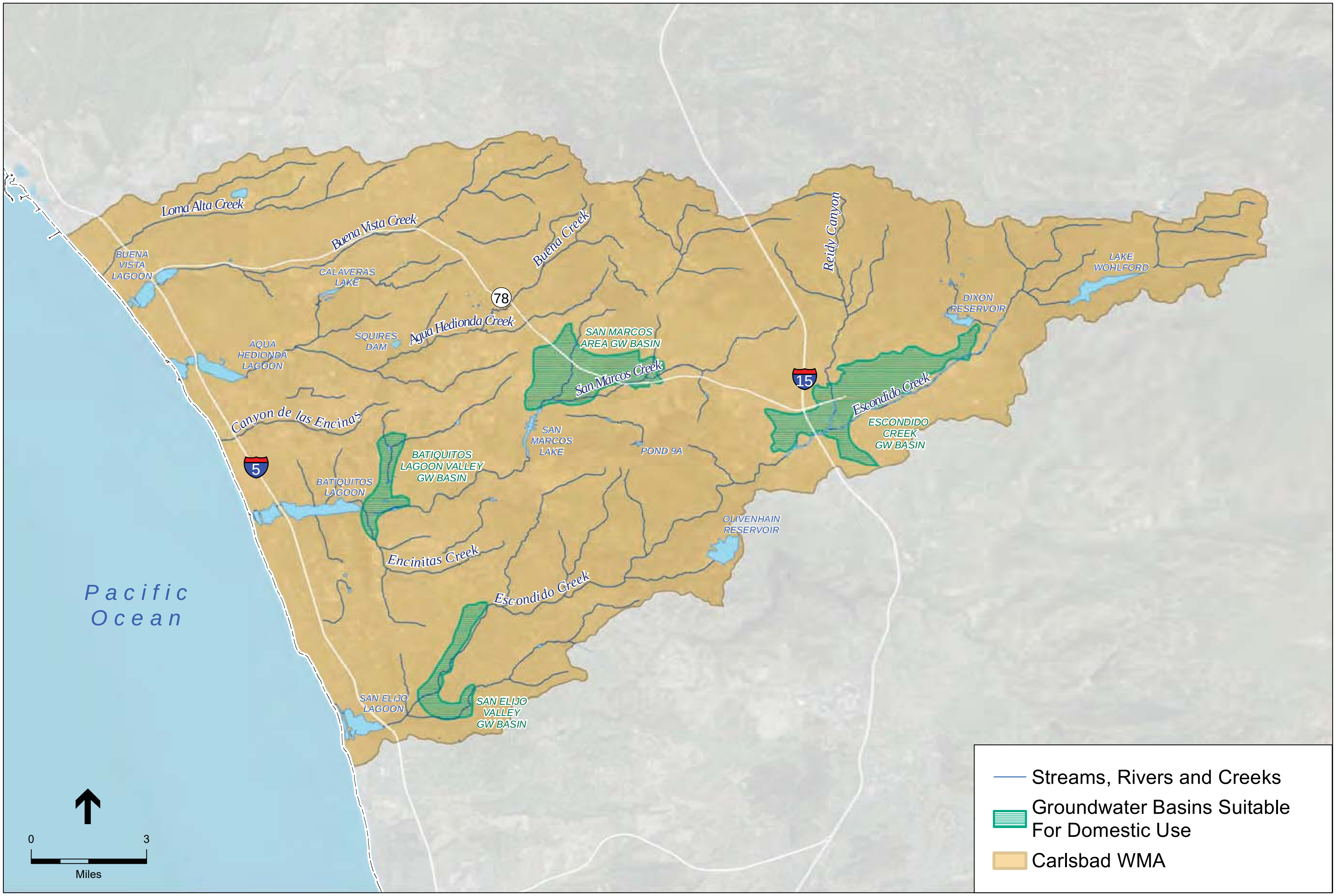




SOURCE: ESRI, 2016; SanGIS, 2016; IRWM, 2016

SCFS . 160618

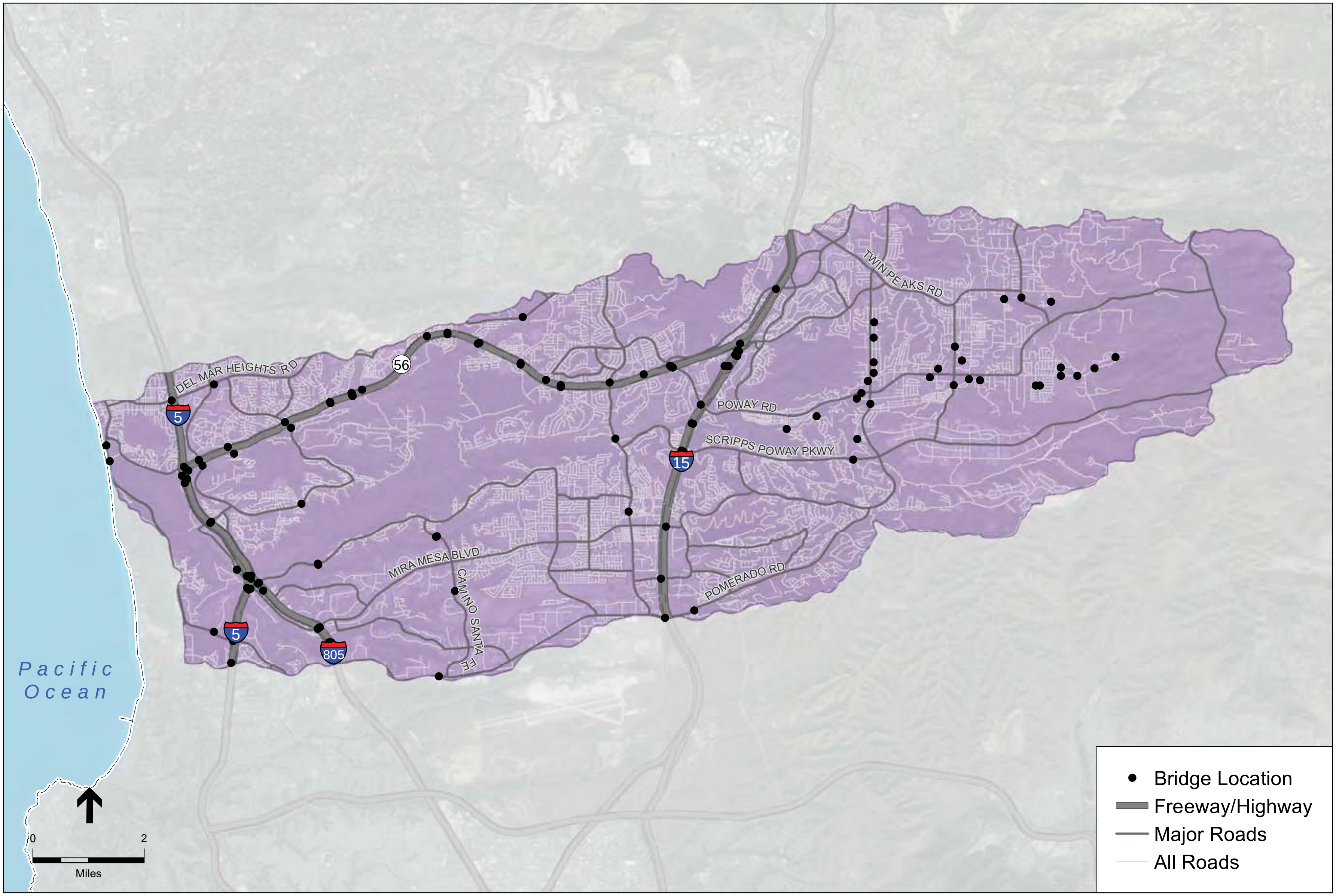
Figure **B-10**
Water Agencies and Wastewater Agencies within the Carlsbad Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 160618

Figure B-11
Water Features within the Carlsbad Water Management Area

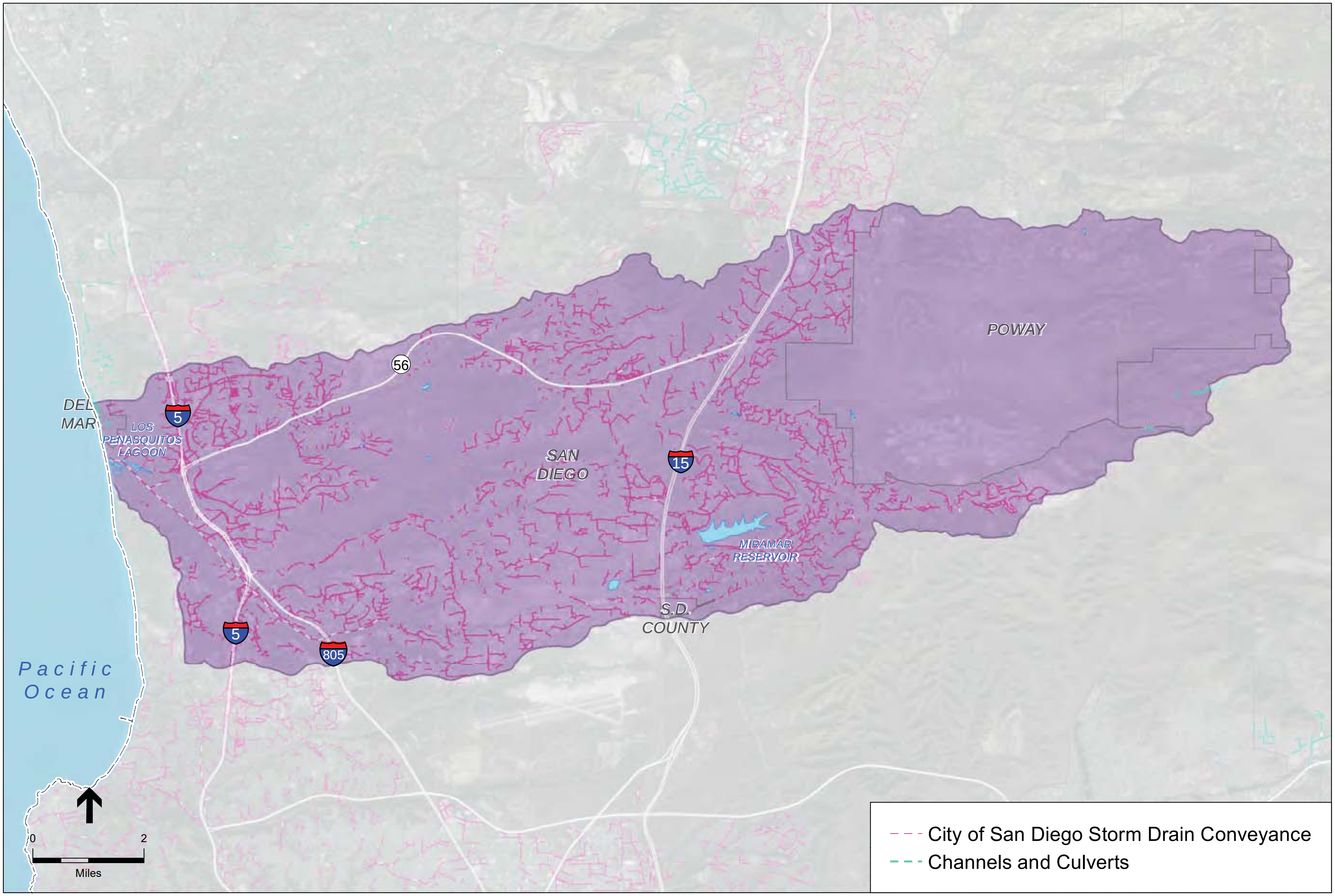


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-12

Built Environments within the Los Penasquitos Water Management Area

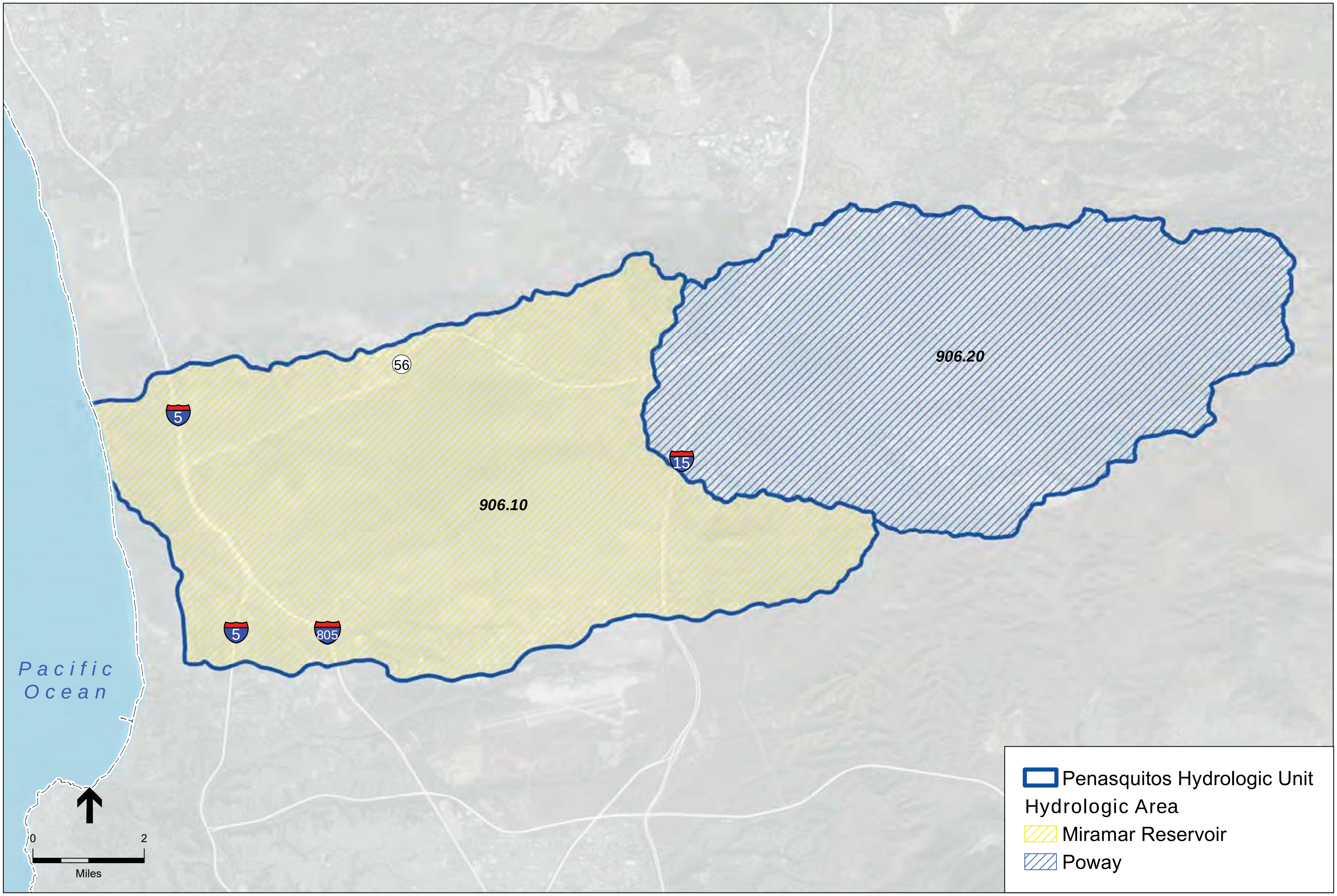


SOURCE: ESRI, 2016; SanGIS, 2016; City of Del Mar, 2016

SCFS . 140075.20

Figure **B-13**

Flood Control System within the Los Penasquitos Water Management Area

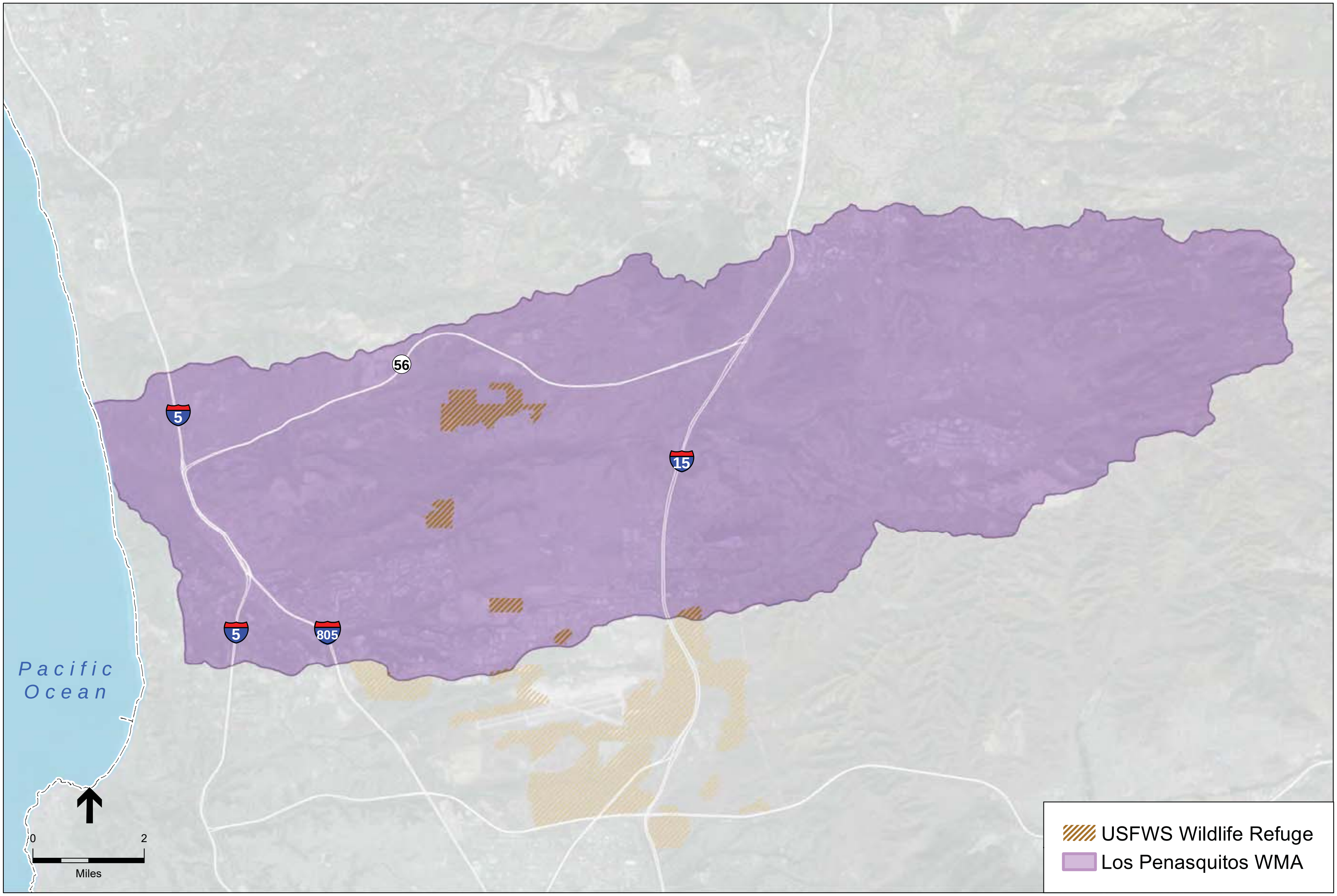


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-14**

Hydrologic Units and Areas within the Los Penasquitos Water Management Area

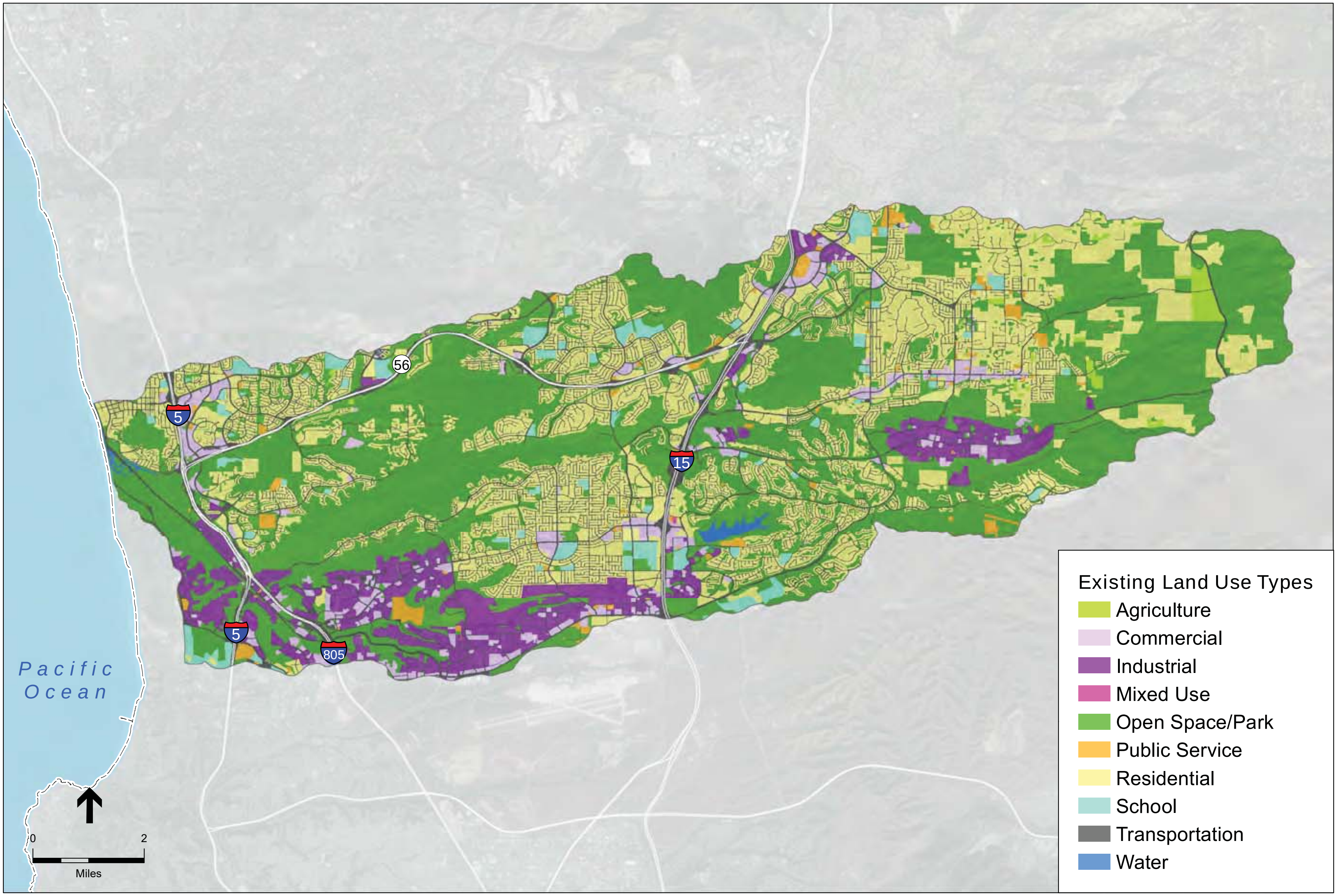


SOURCE: ESRI, 2016; SanGIS, 2016; USFWS, 2016

SCFS . 140075.20

Figure B-15

Land Use Agencies within the Los Penasquitos Water Management Area

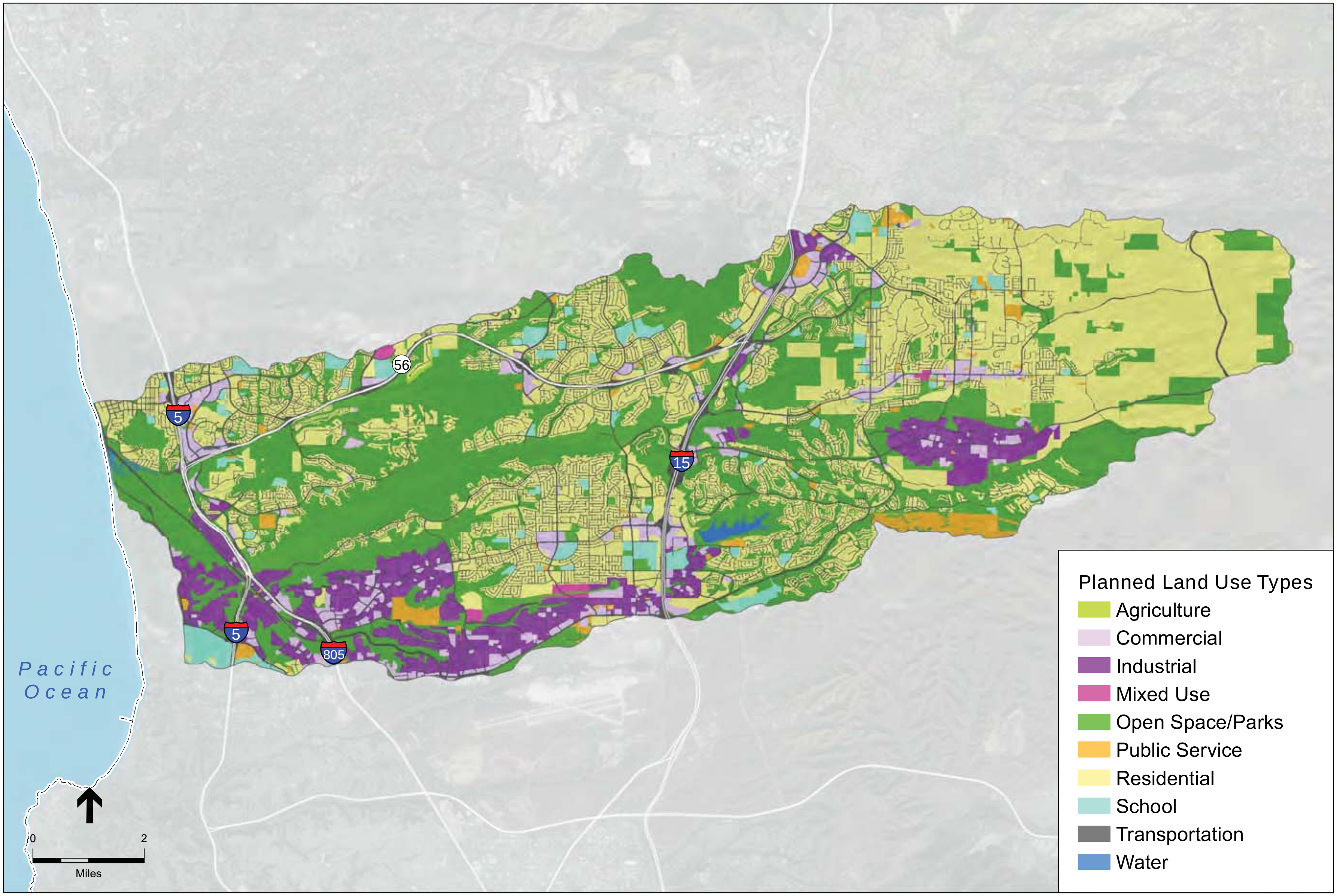


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-16**

Existing Land Use within the Los Penasquitos Water Management Area

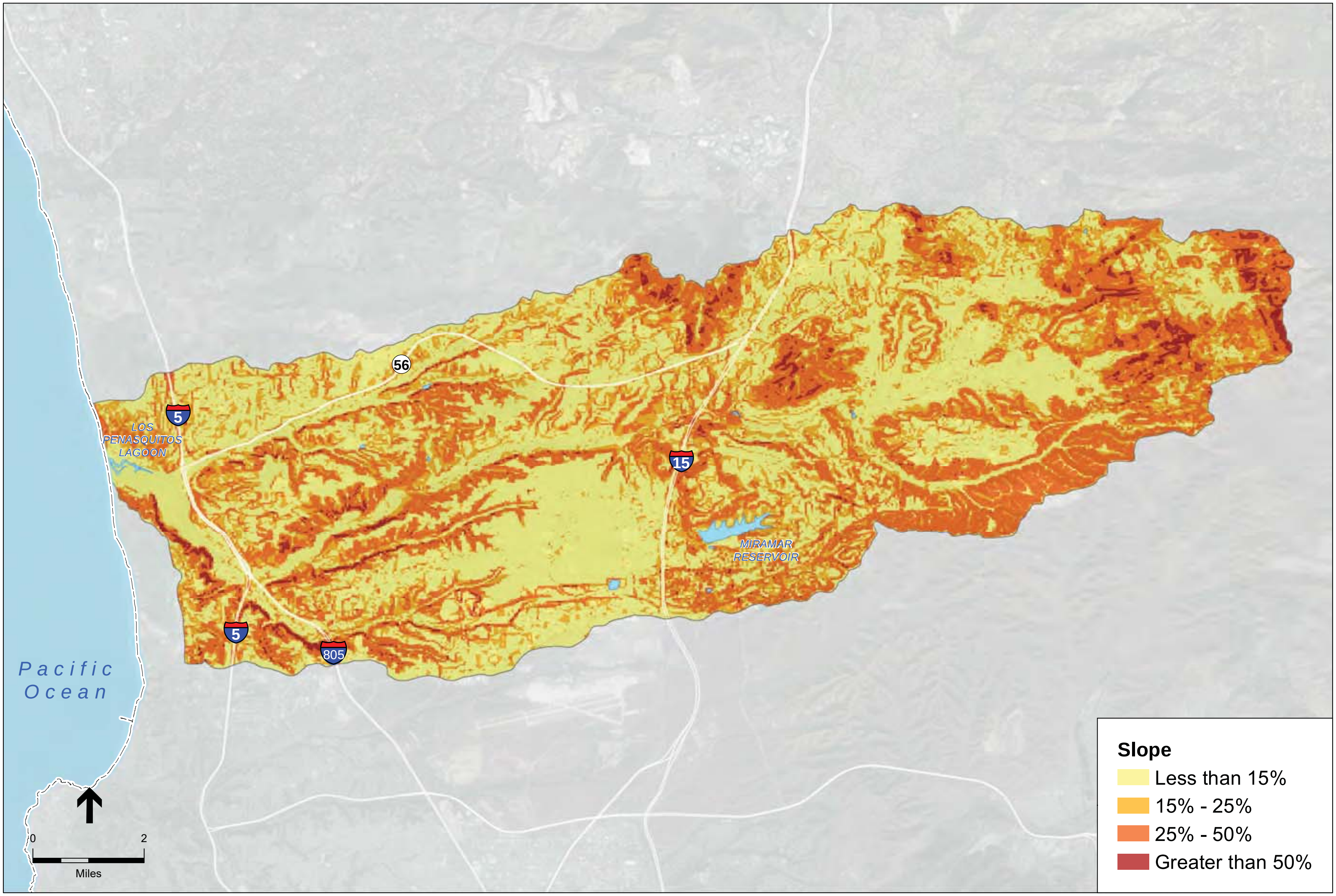


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-17**

Planned Land Use within the Los Penasquitos Water Management Area

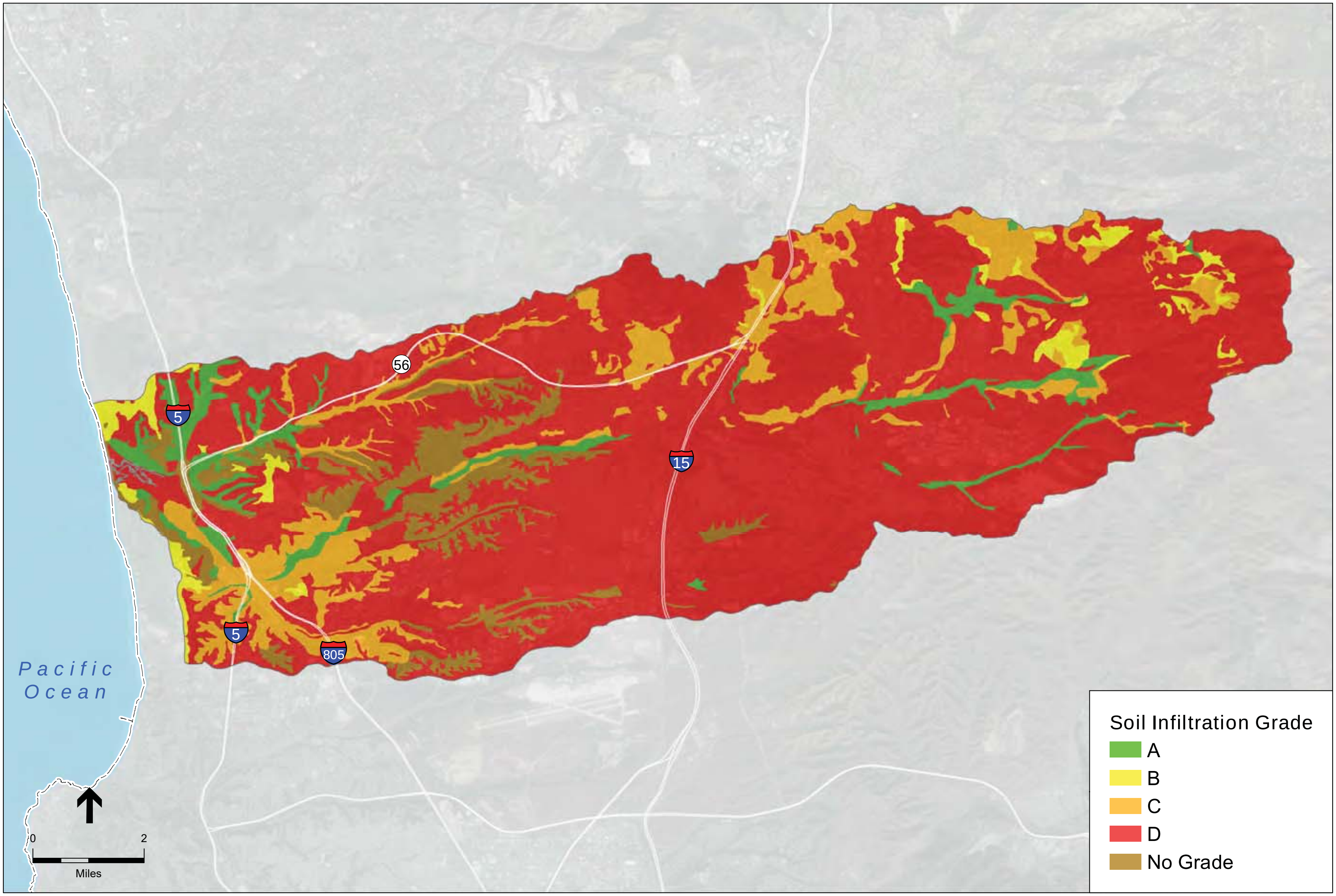


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-18

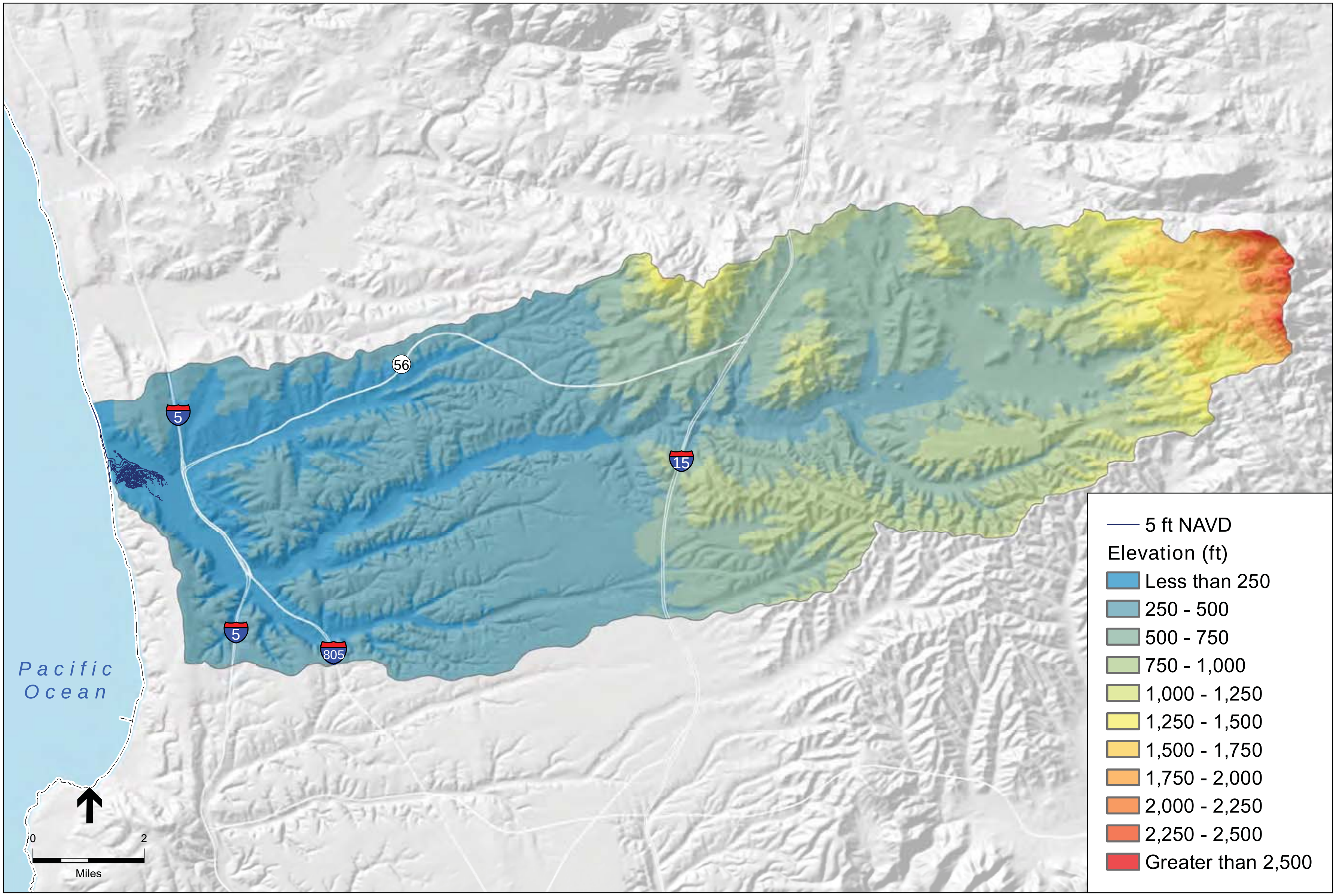
Water Features within the Los Penasquitos Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016; USDA

SCFS . 140075.20

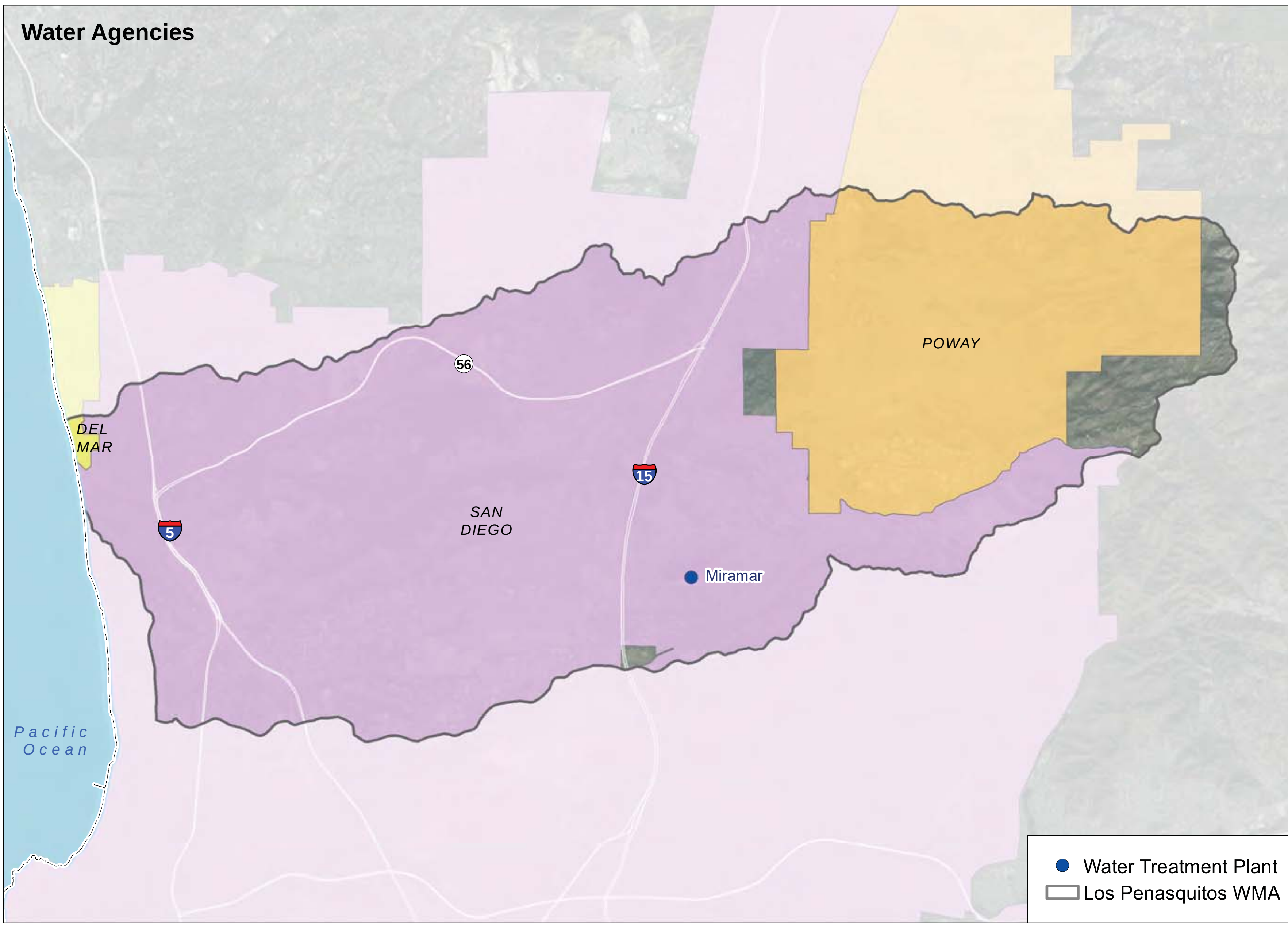
Figure **B-19**
Soil Types within the Los Penasquitos Water Management Area

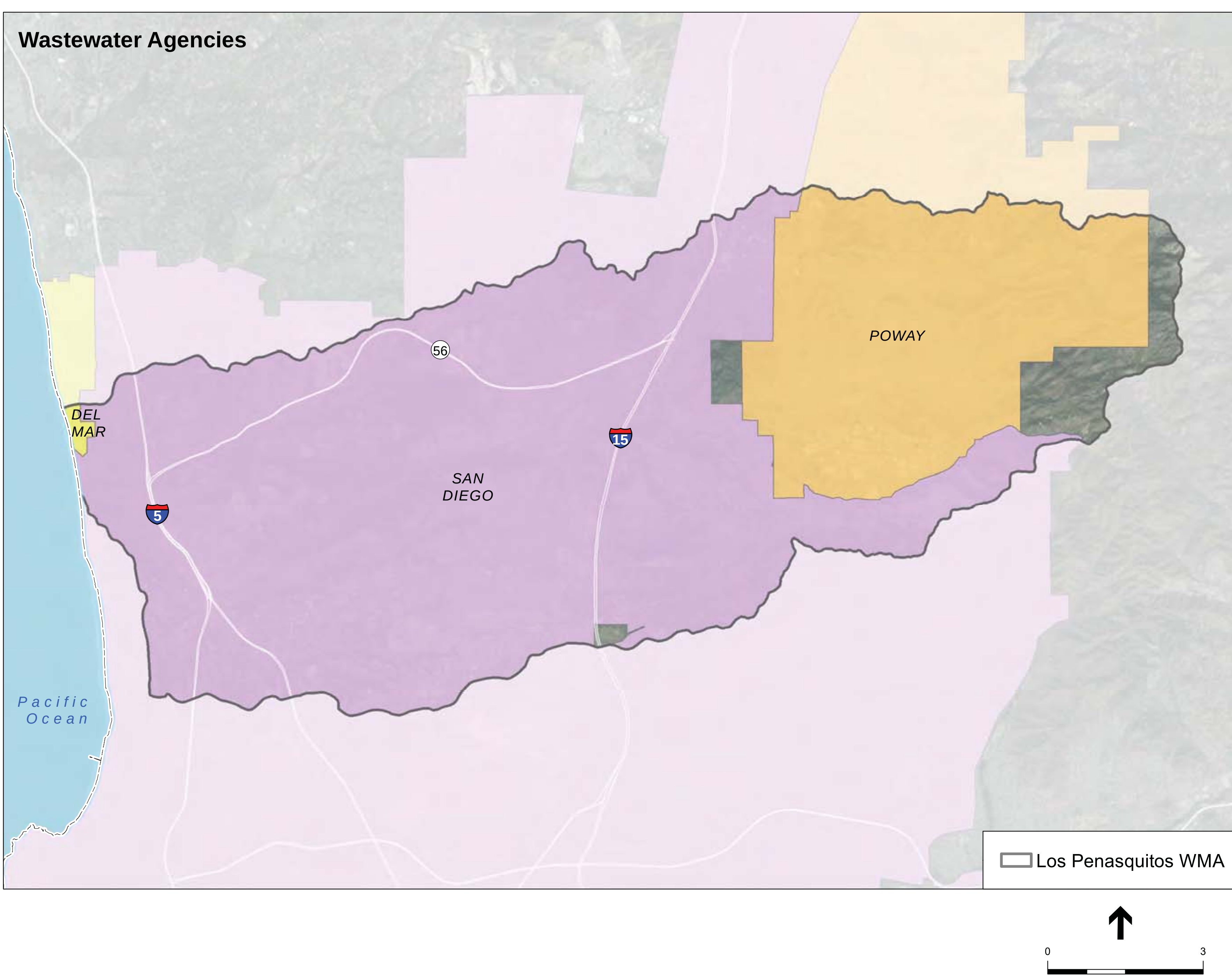


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-20
Water Features within the Los Penasquitos Water Management Area



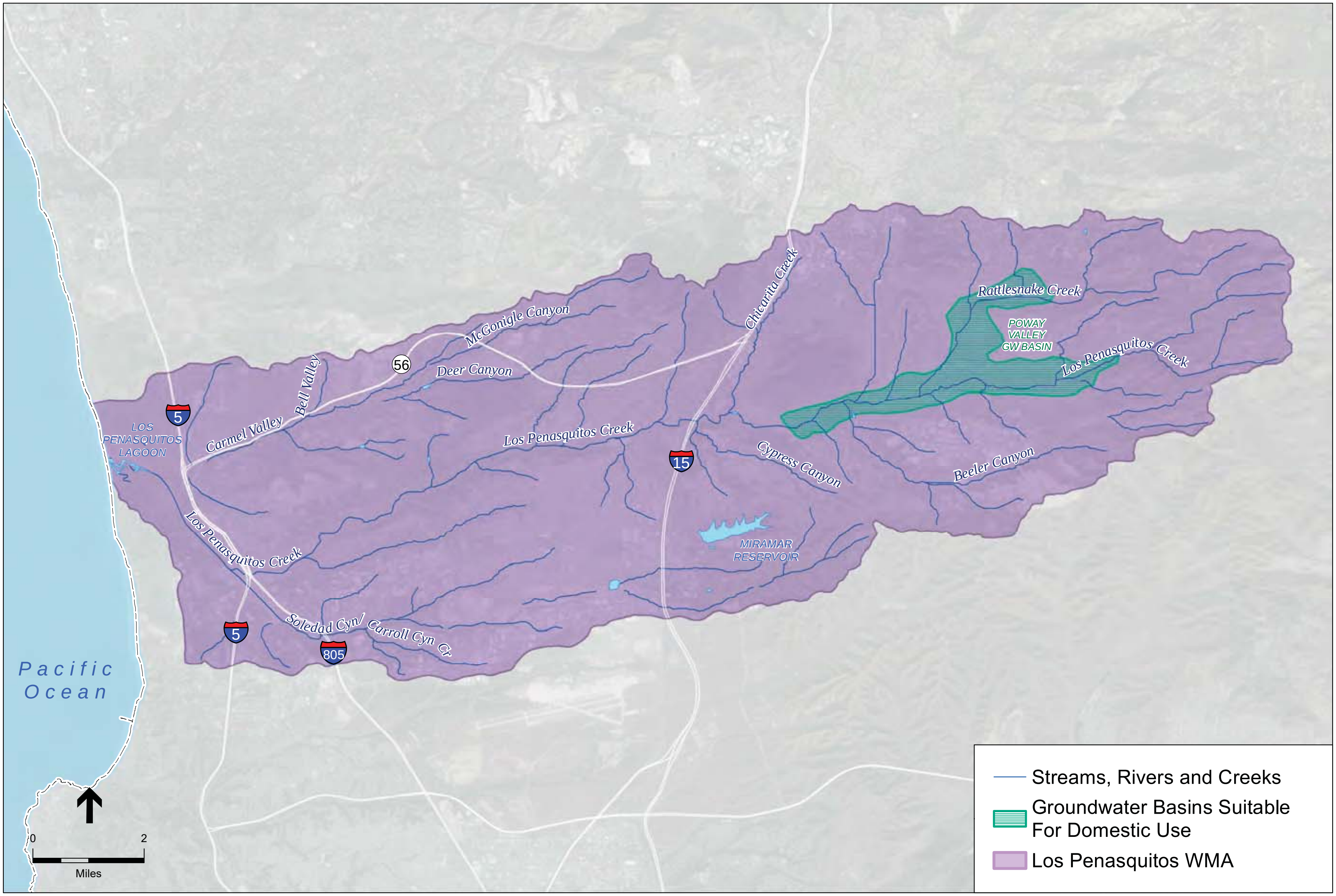


SOURCE: ESRI, 2016; SanGIS, 2016; IRWM, 2016

SCFS . 140075.20

Figure B-21

Water Agencies and Wastewater Agencies within the Los Penasquitos Water Management Area

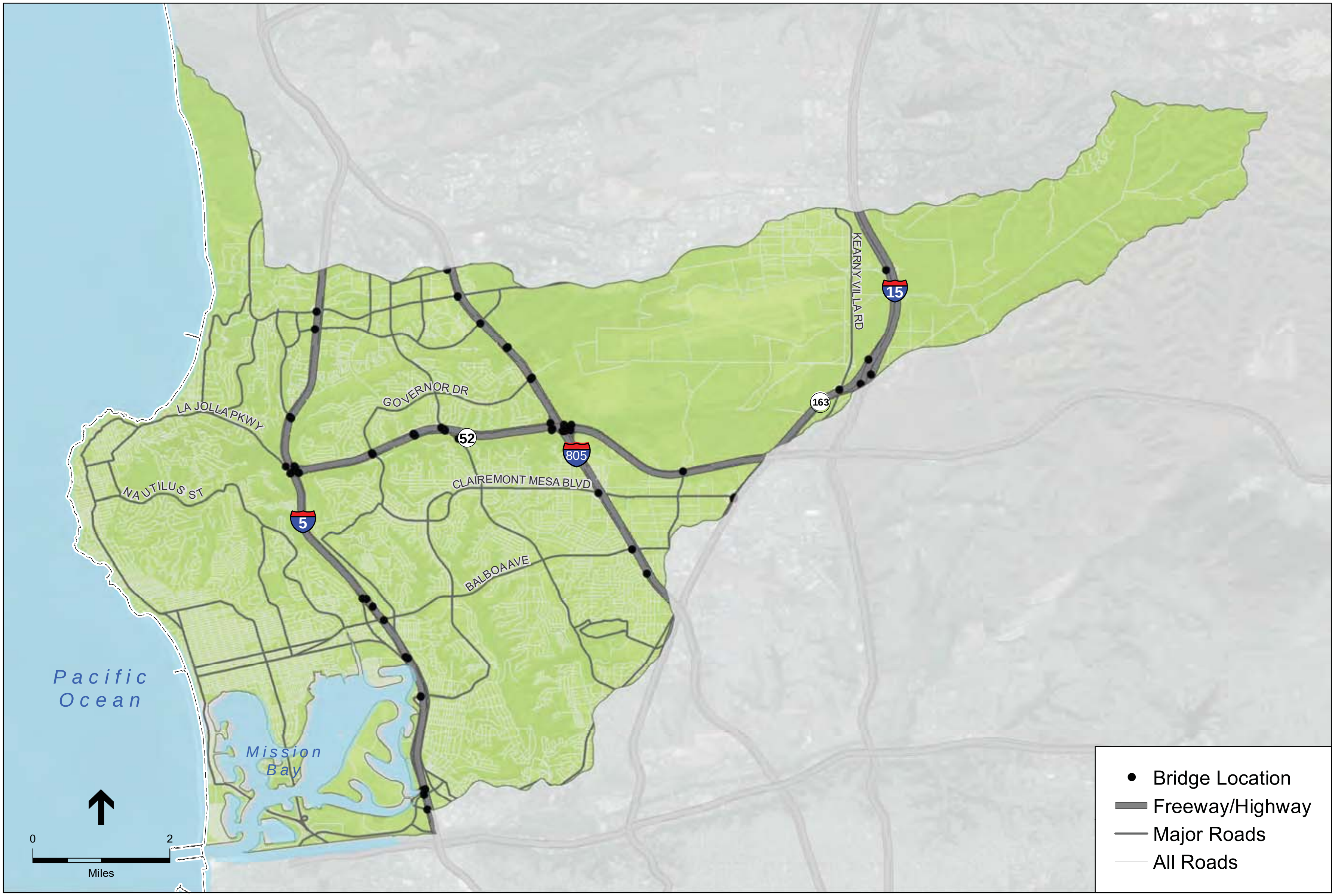


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-22**

Water Features within the Los Penasquitos Water Management Area

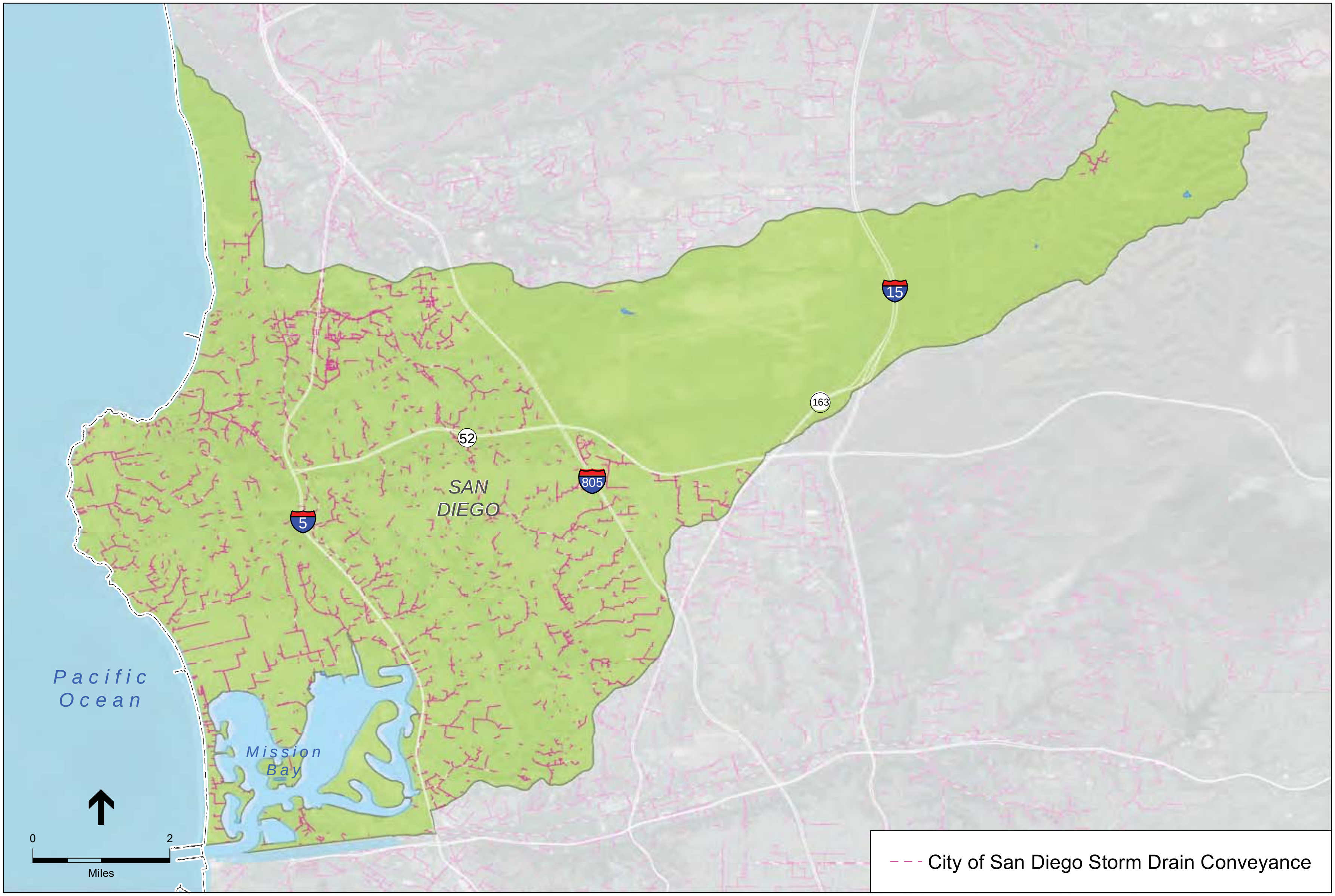


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-23

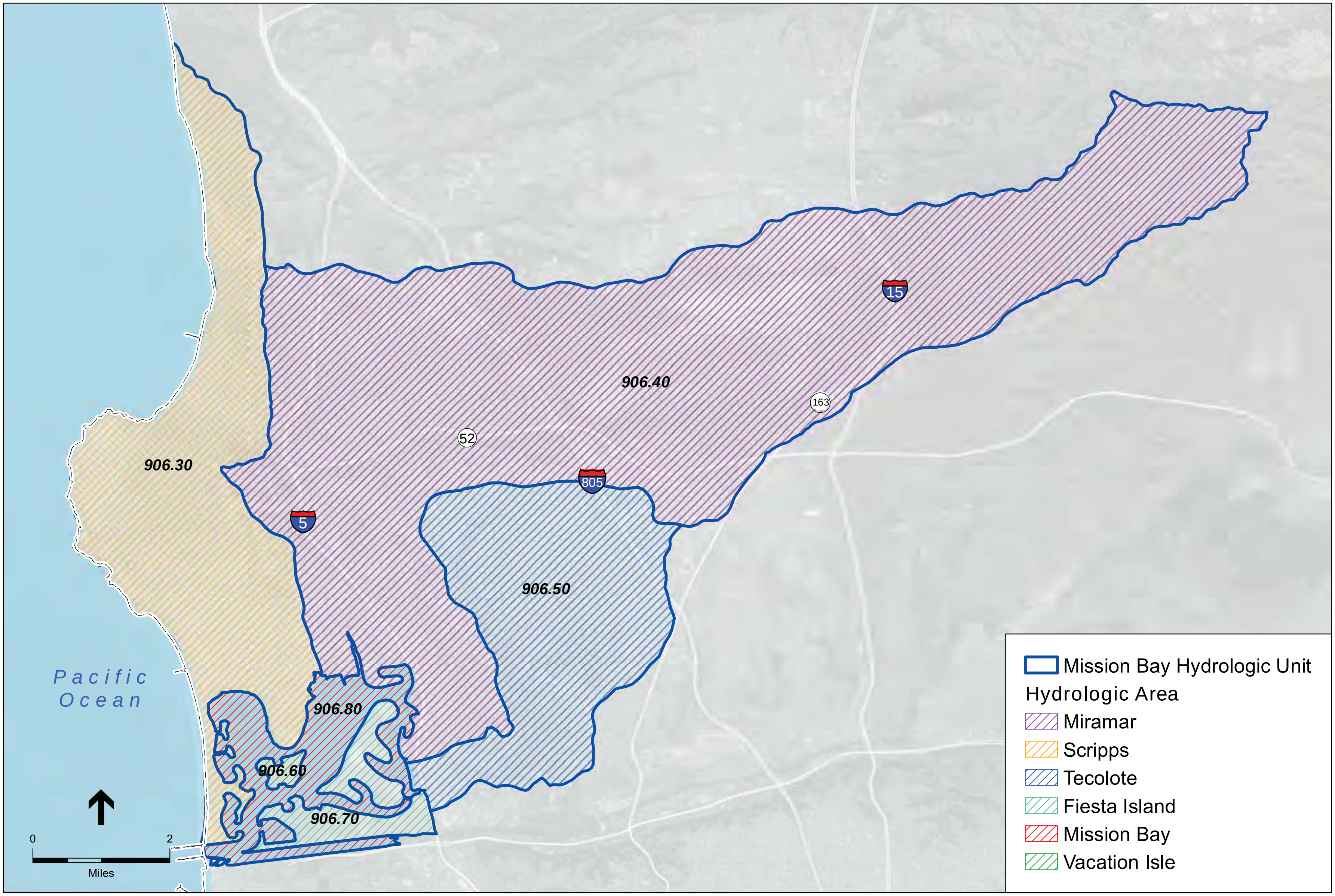
Built Environments within the Mission Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 160618

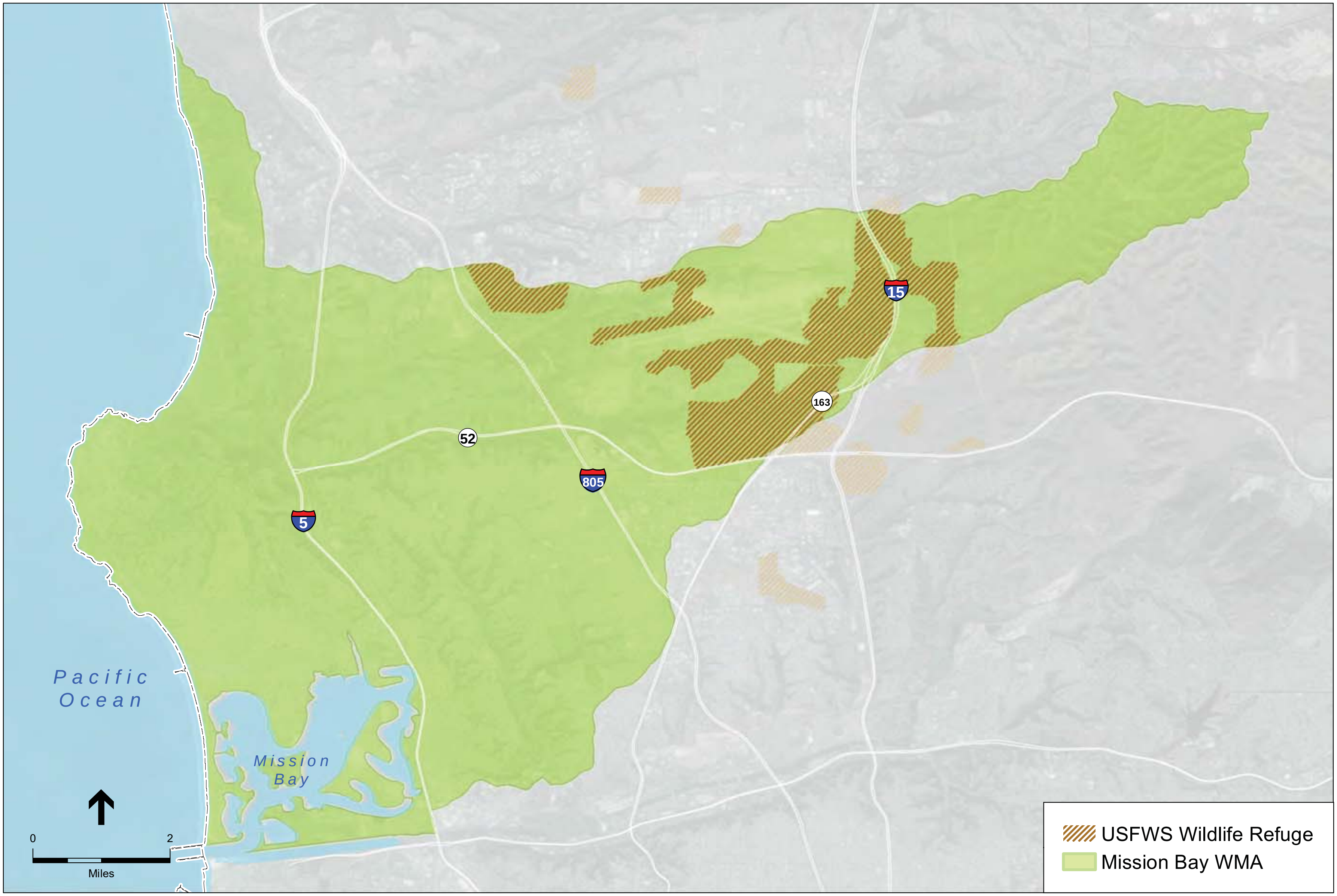
Figure **B-24**
Flood Control System within the Mission Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 160618

Figure **B-25**
Hydrologic Units and Areas within the Mission Bay Water Management Area

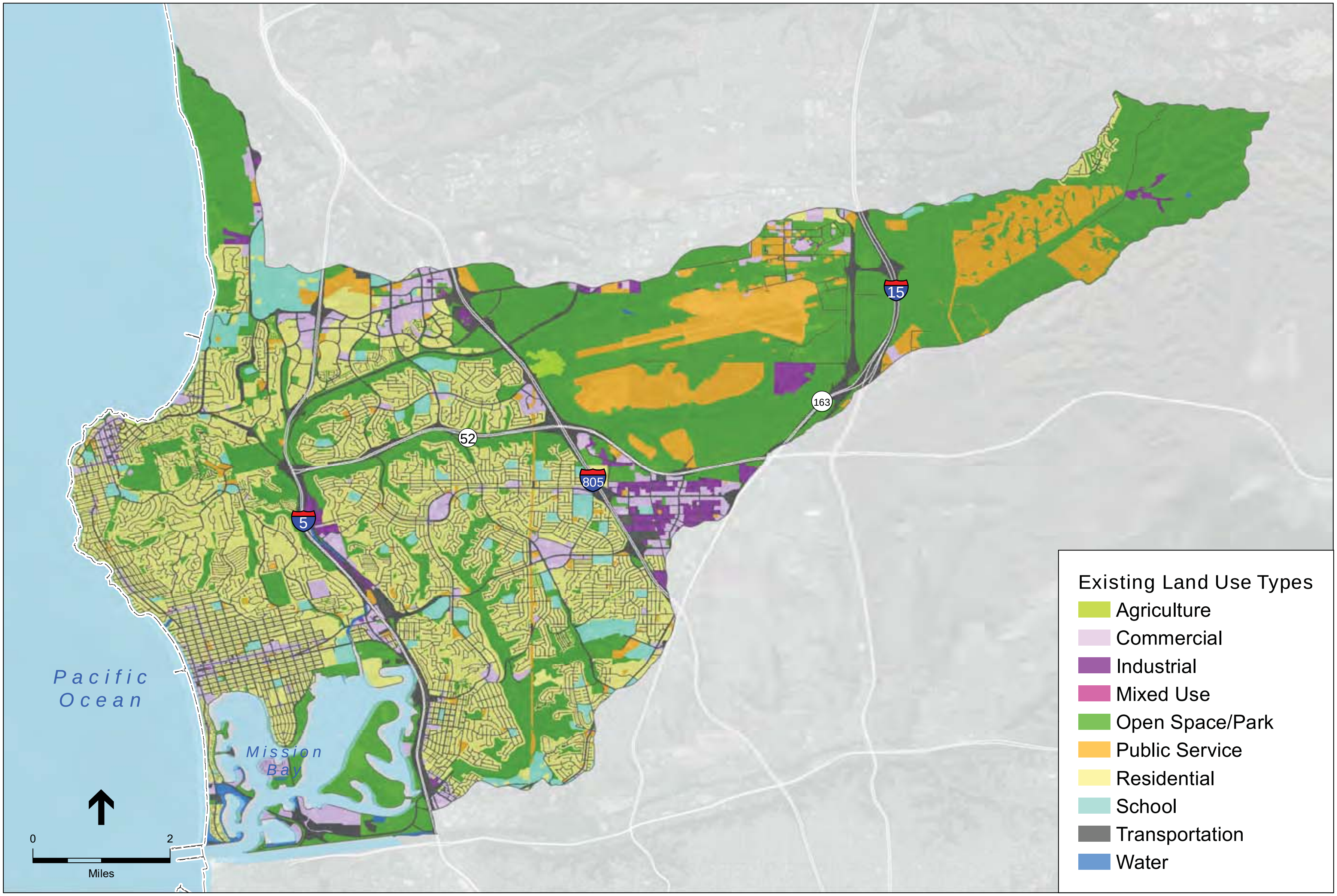


SOURCE: ESRI, 2016; SanGIS, 2016; USFWS, 2016

SCFS . 140075.20

Figure B-26

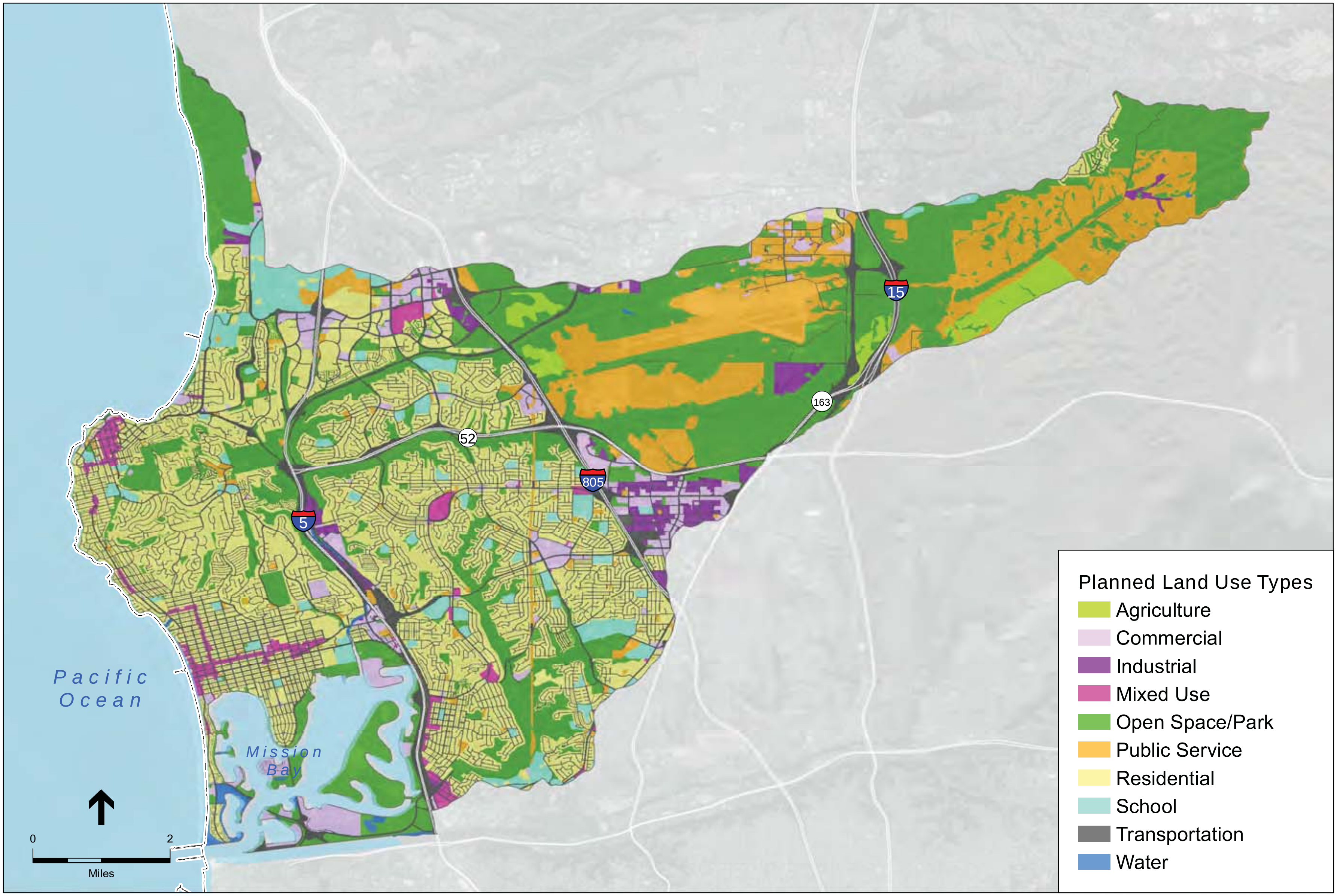
Land Use Agencies within the Mission Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2017

SCFS . 160618

Figure **B-27**
Existing Land Use within the Mission Bay Water Management Area

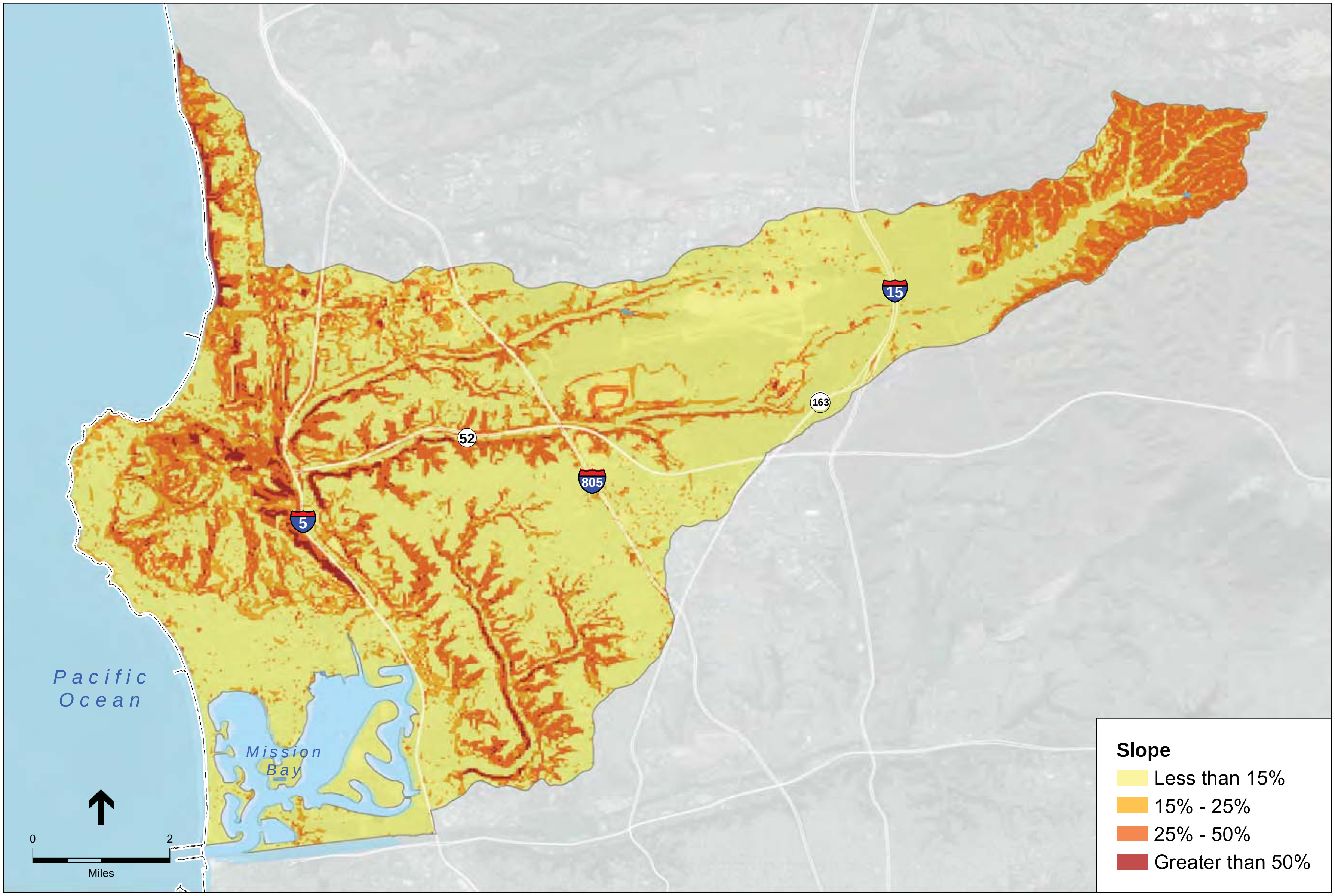


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-28**

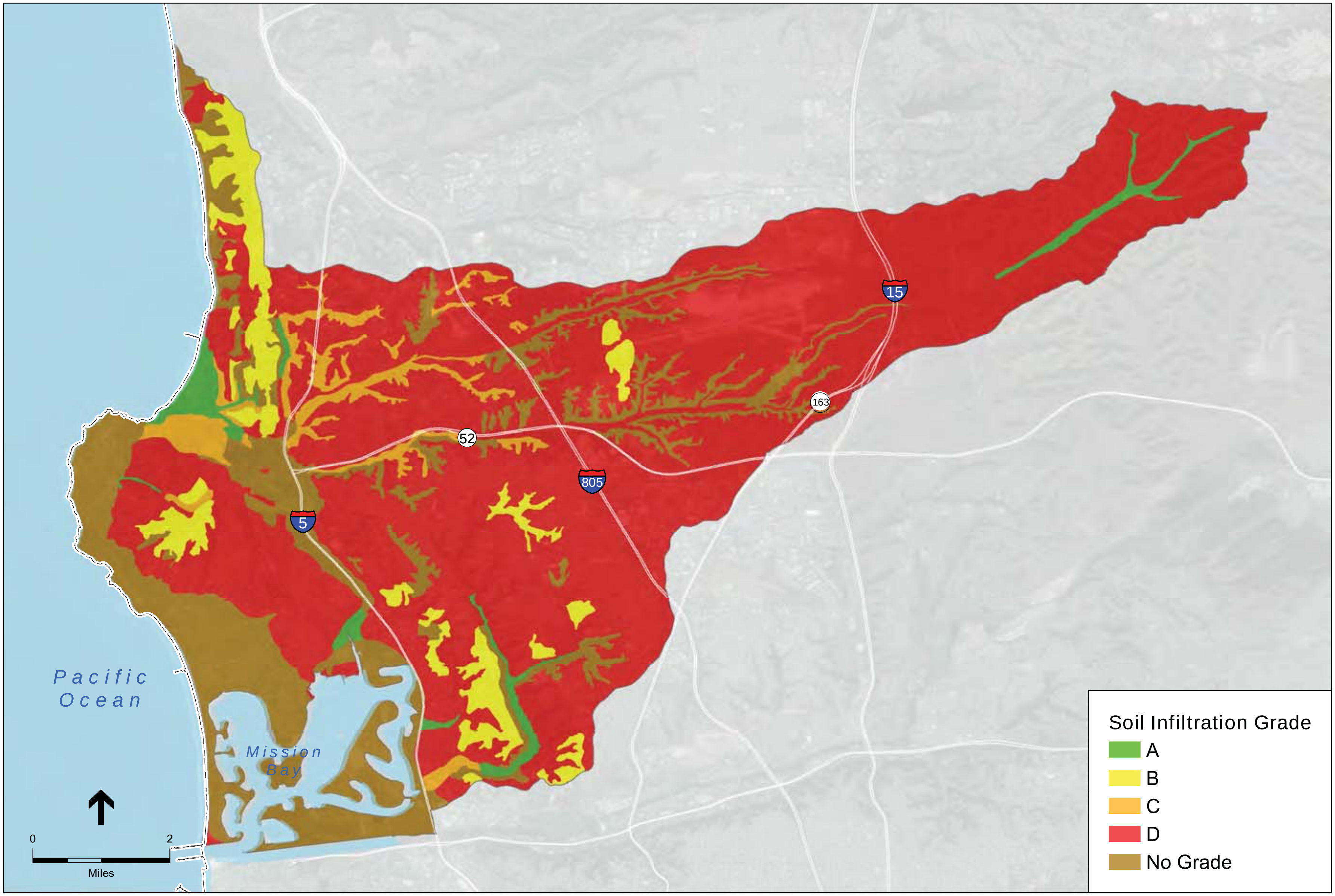
Planned Land Use within the Mission Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 160618

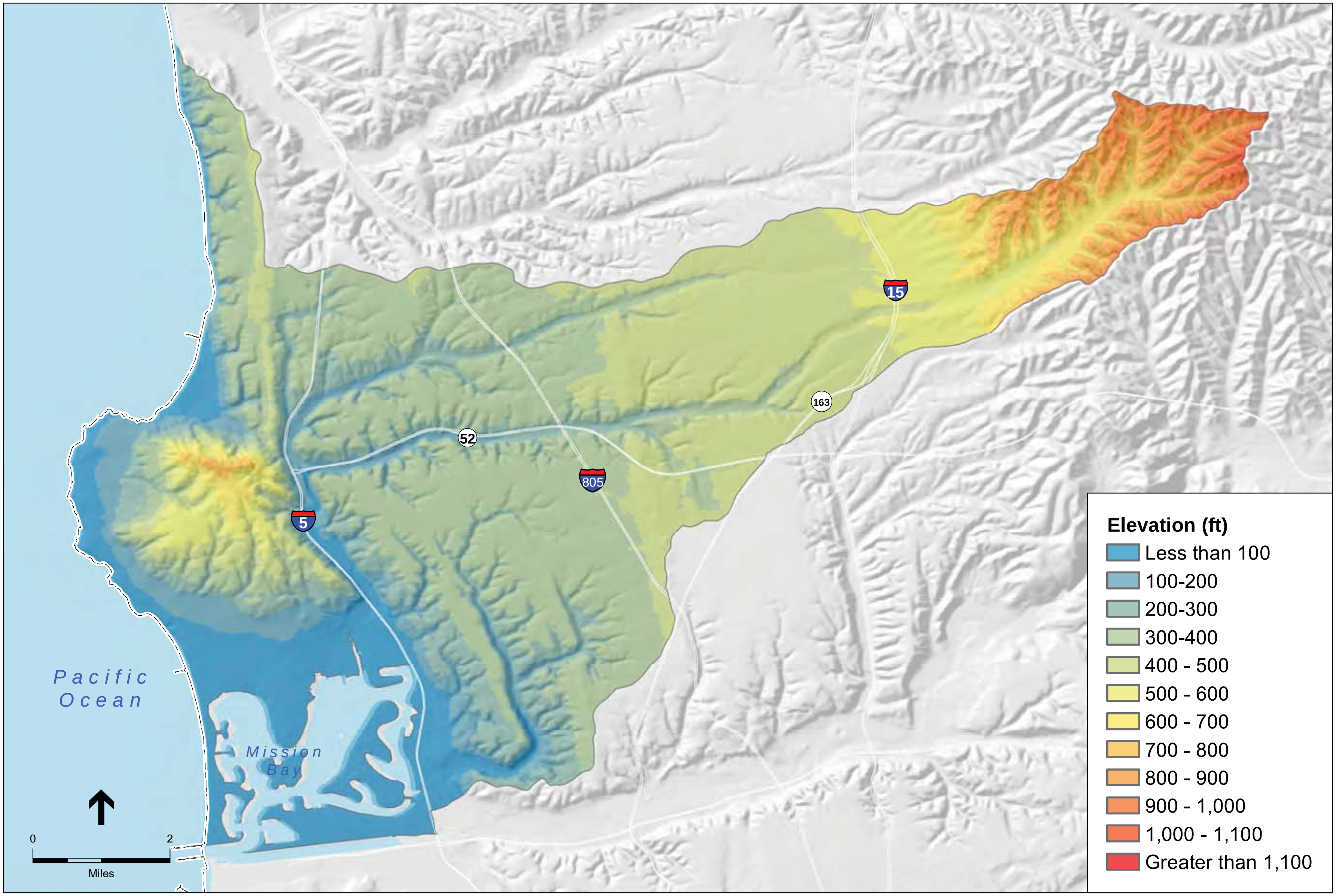
Figure B-29
Slope within the Mission Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2017; USDA

SCFS . 140075.20

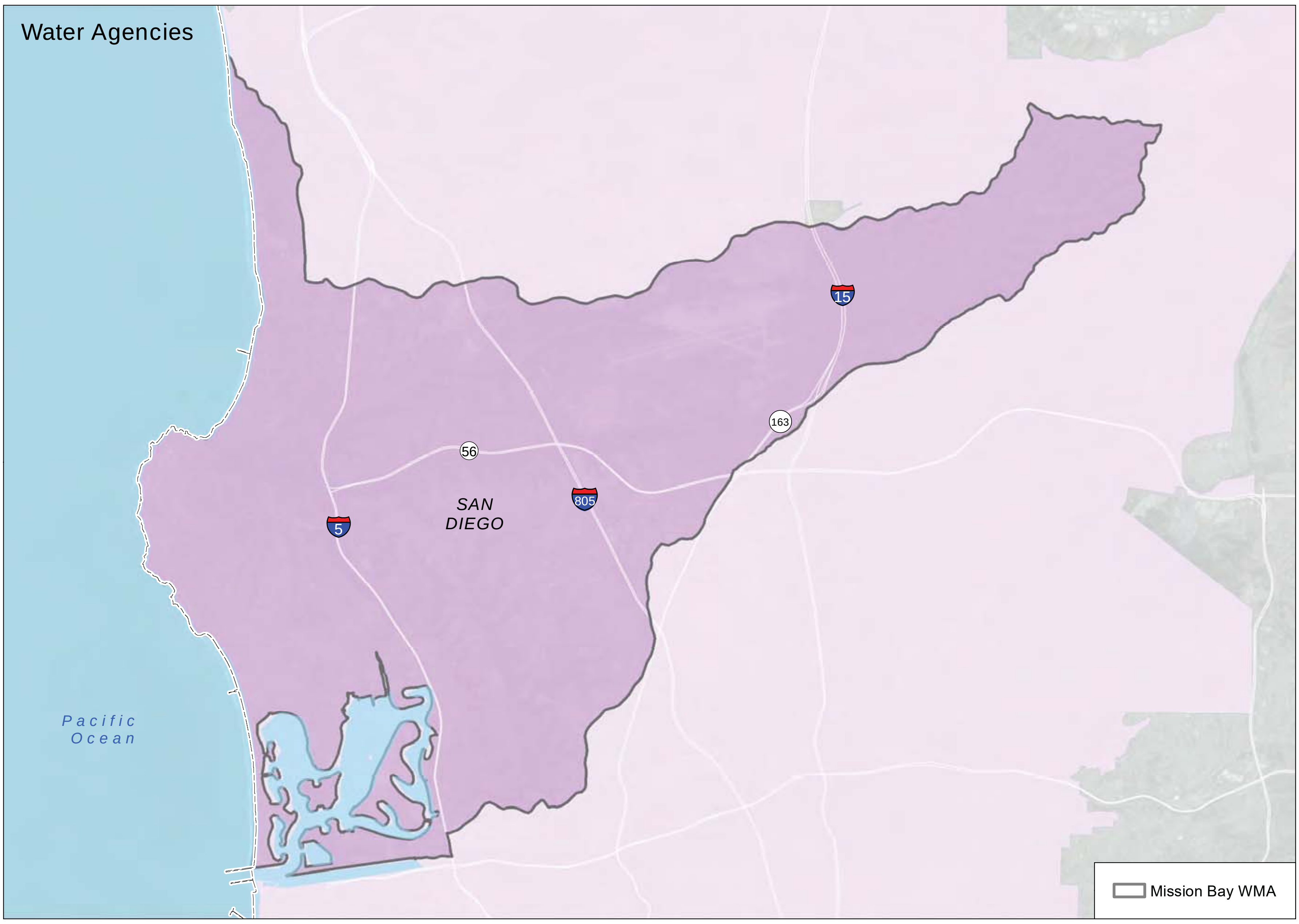
Figure **B-30**
Soils within the Mission Bay Water Management Area

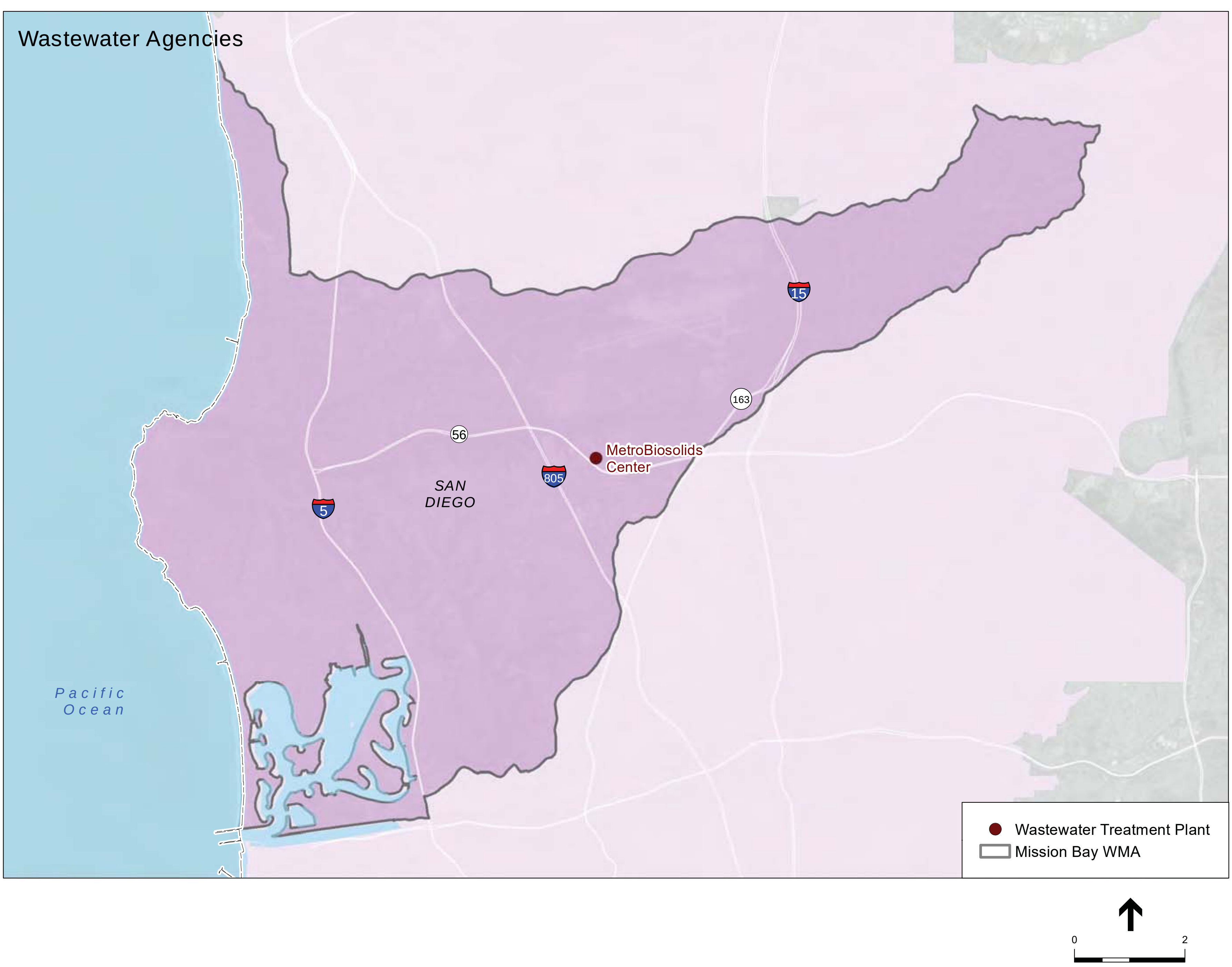


SOURCE: ESRI, 2016; SanGIS, 2017; USGS 2017

SCFS . 140075.20

Figure B-31
Topography within the Mission Bay Water Management Area

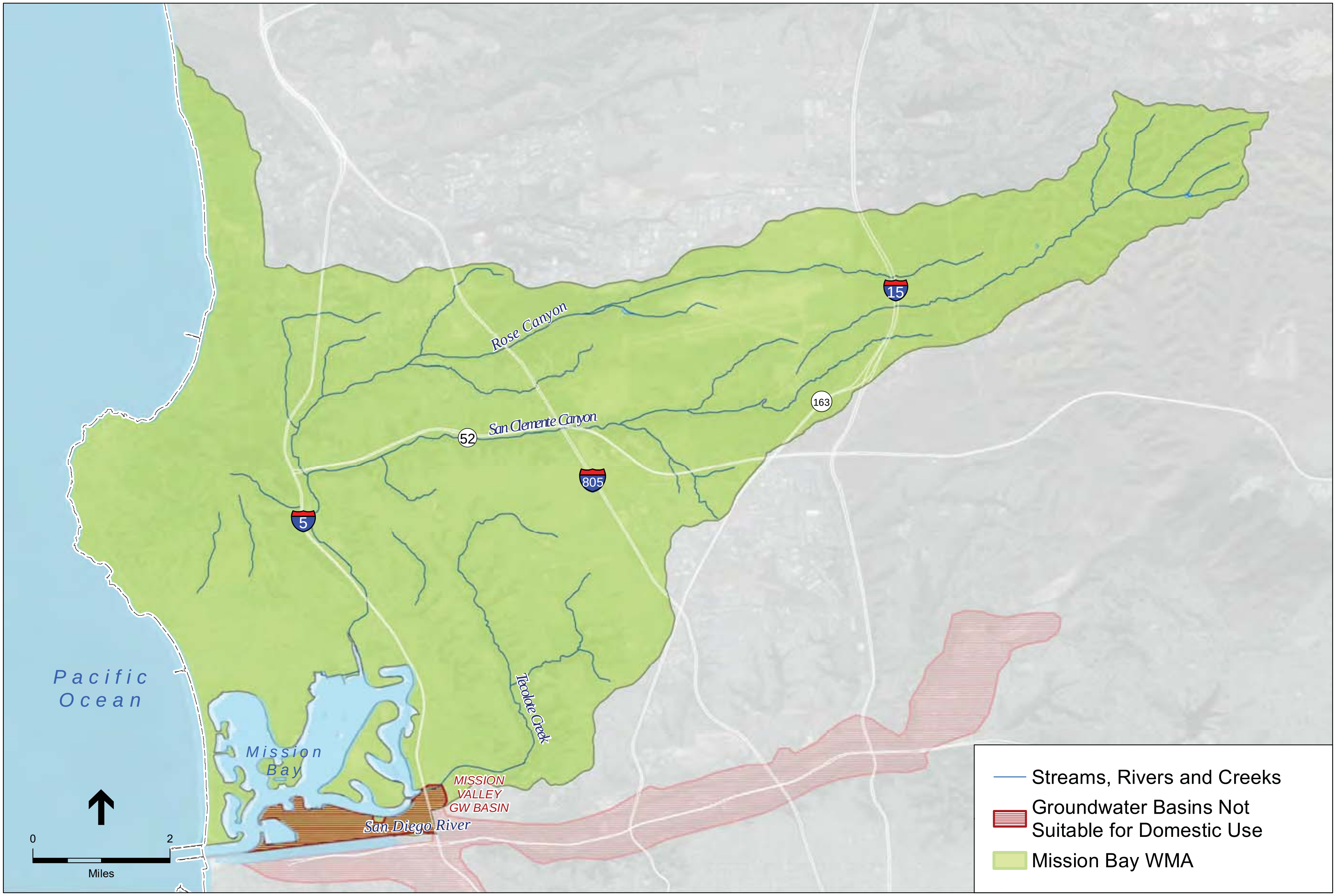




SOURCE: ESRI, 2016; SanGIS, 2016; IRWM, 2016

SCFS . 140075.20

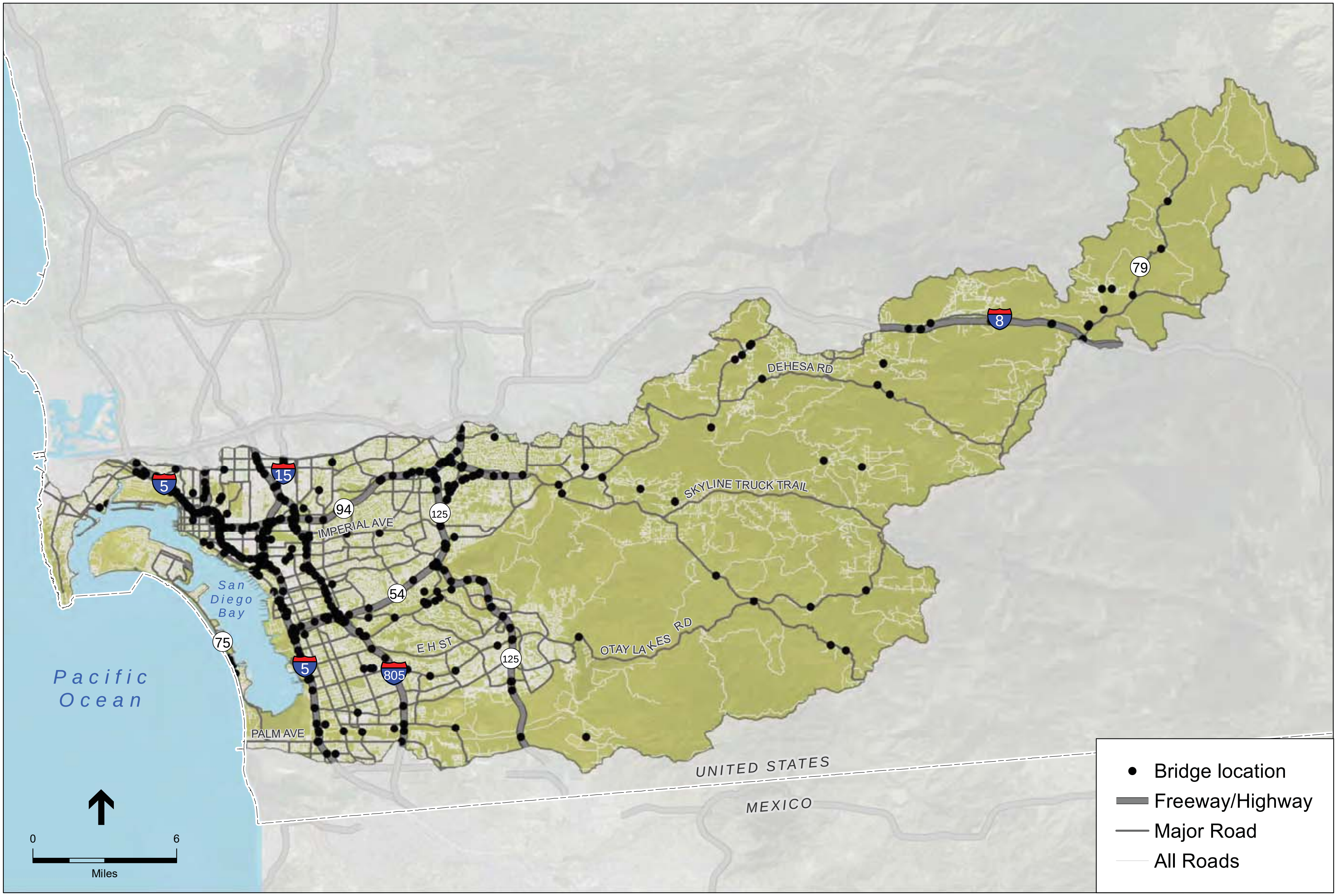
Figure **B-32**
Water Agencies and Wastewater Agencies within the Mission Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 160618

Figure B-33
Water Features within the Mission Bay Water Management Area

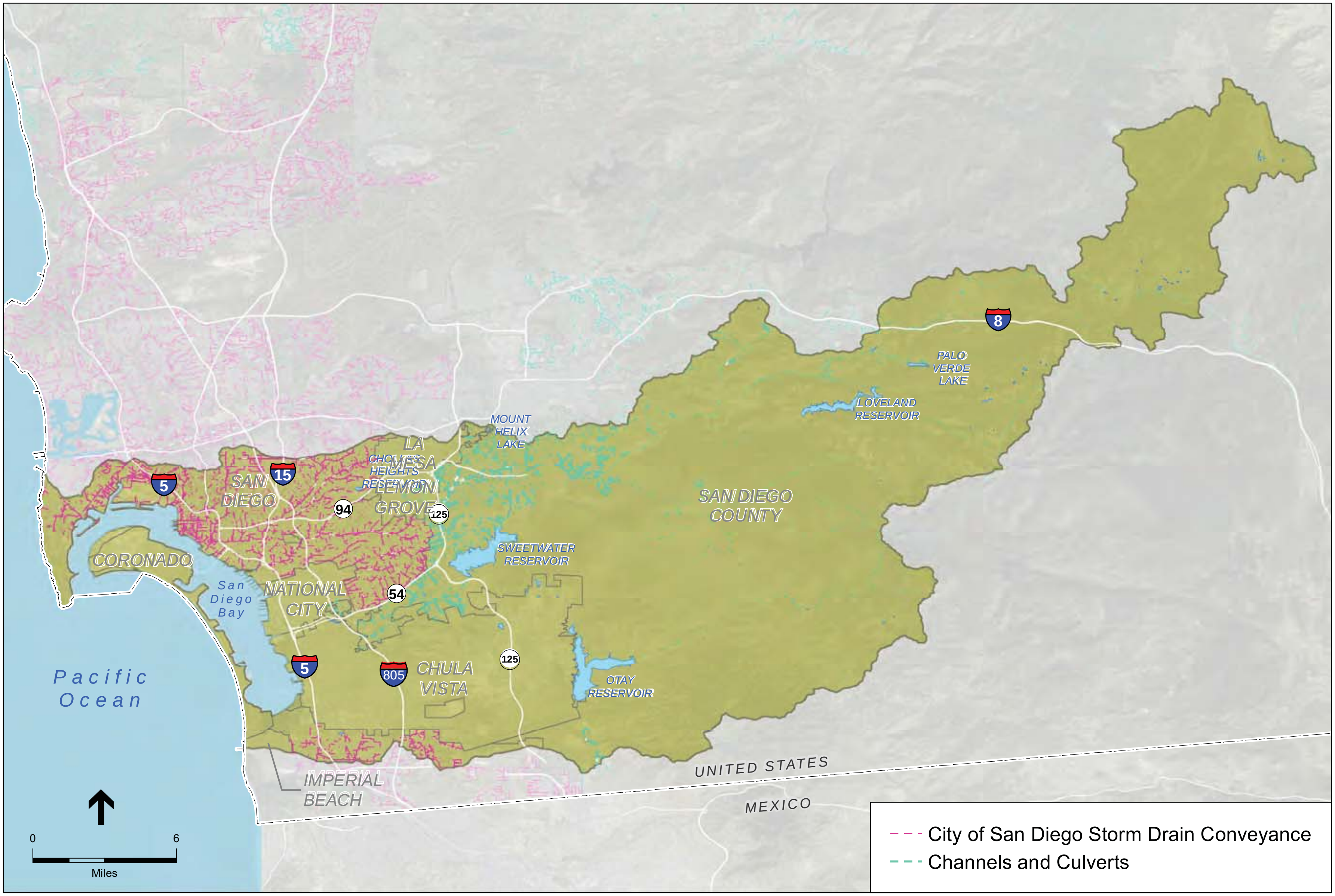


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-34**

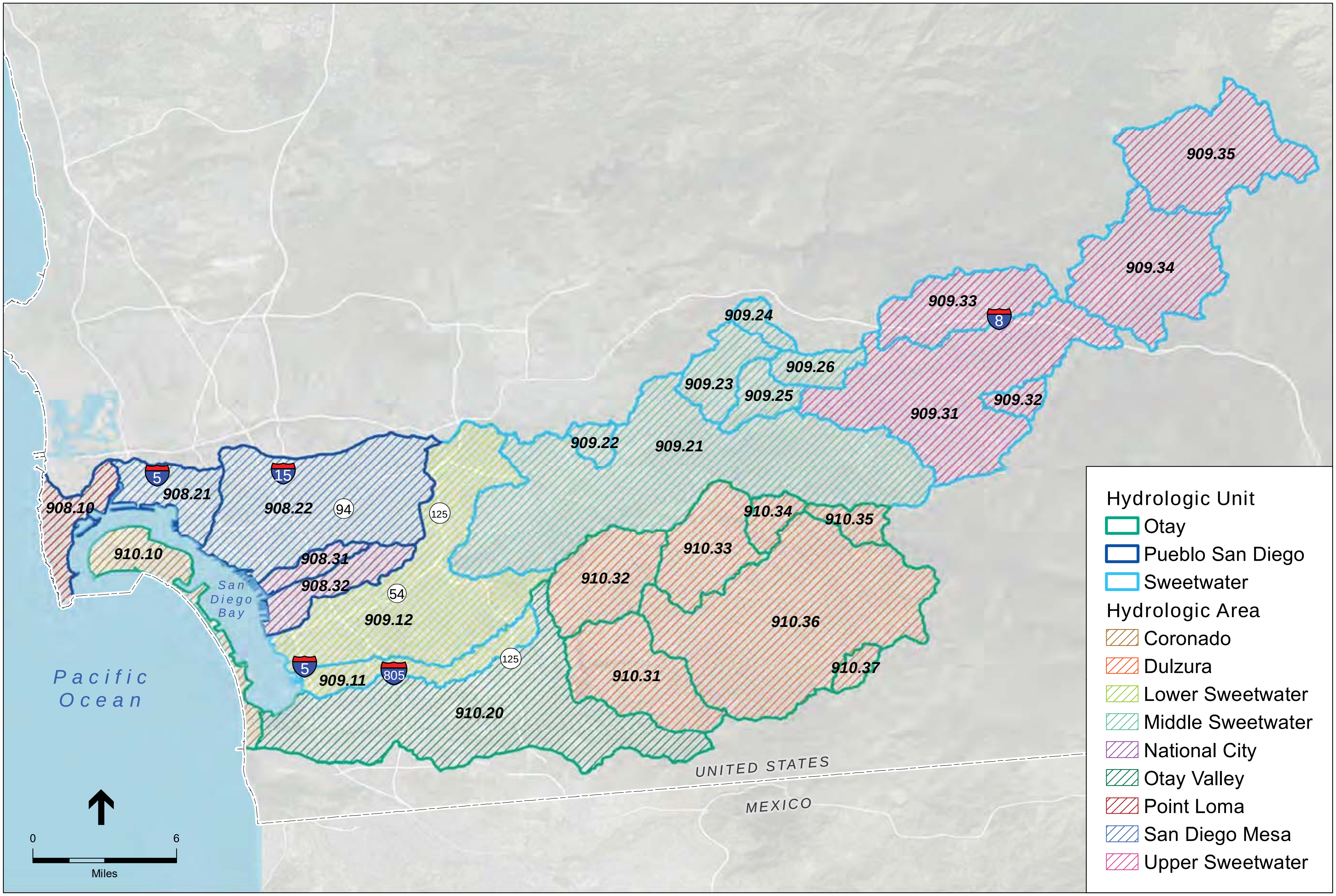
Built Environments within the San Diego Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-35
Flood Control System within the San Diego Bay Water Management Area

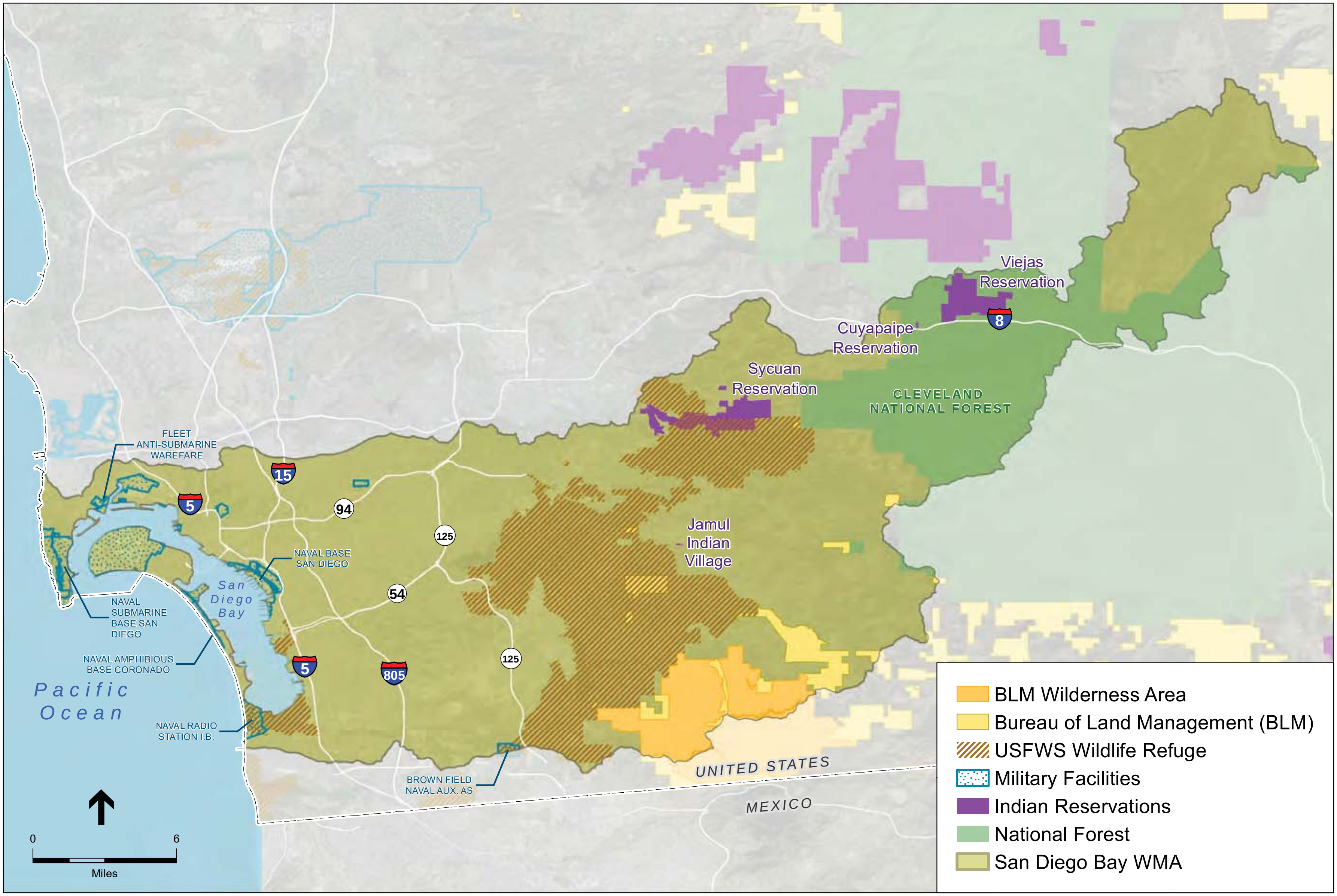


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-36**

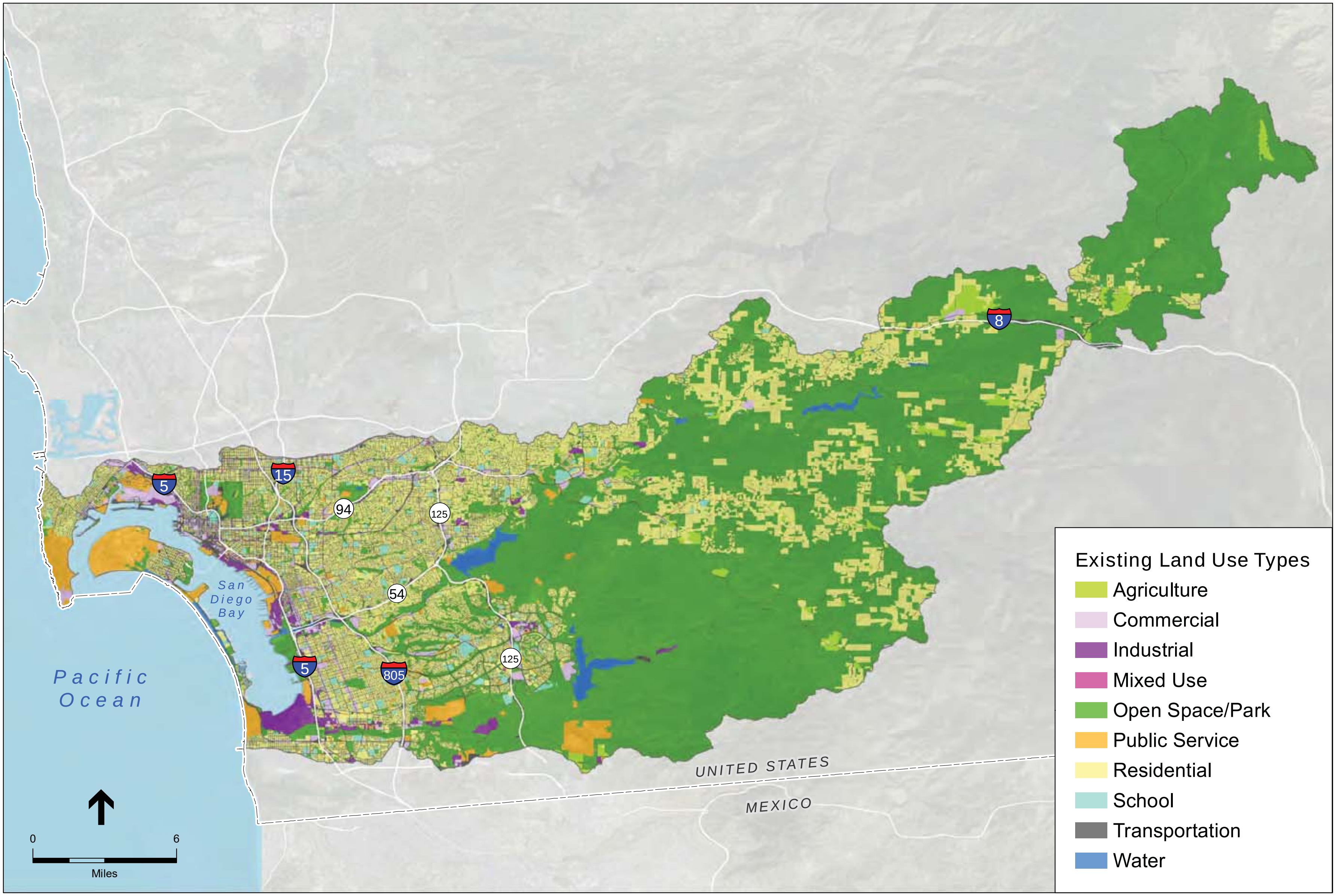
Hydrologic Units and Areas within the San Diego Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016; Bureau of Land Management

SCFS . 140075.20

Figure B-37
Land Use Agencies within the San Diego Bay Water Management Area

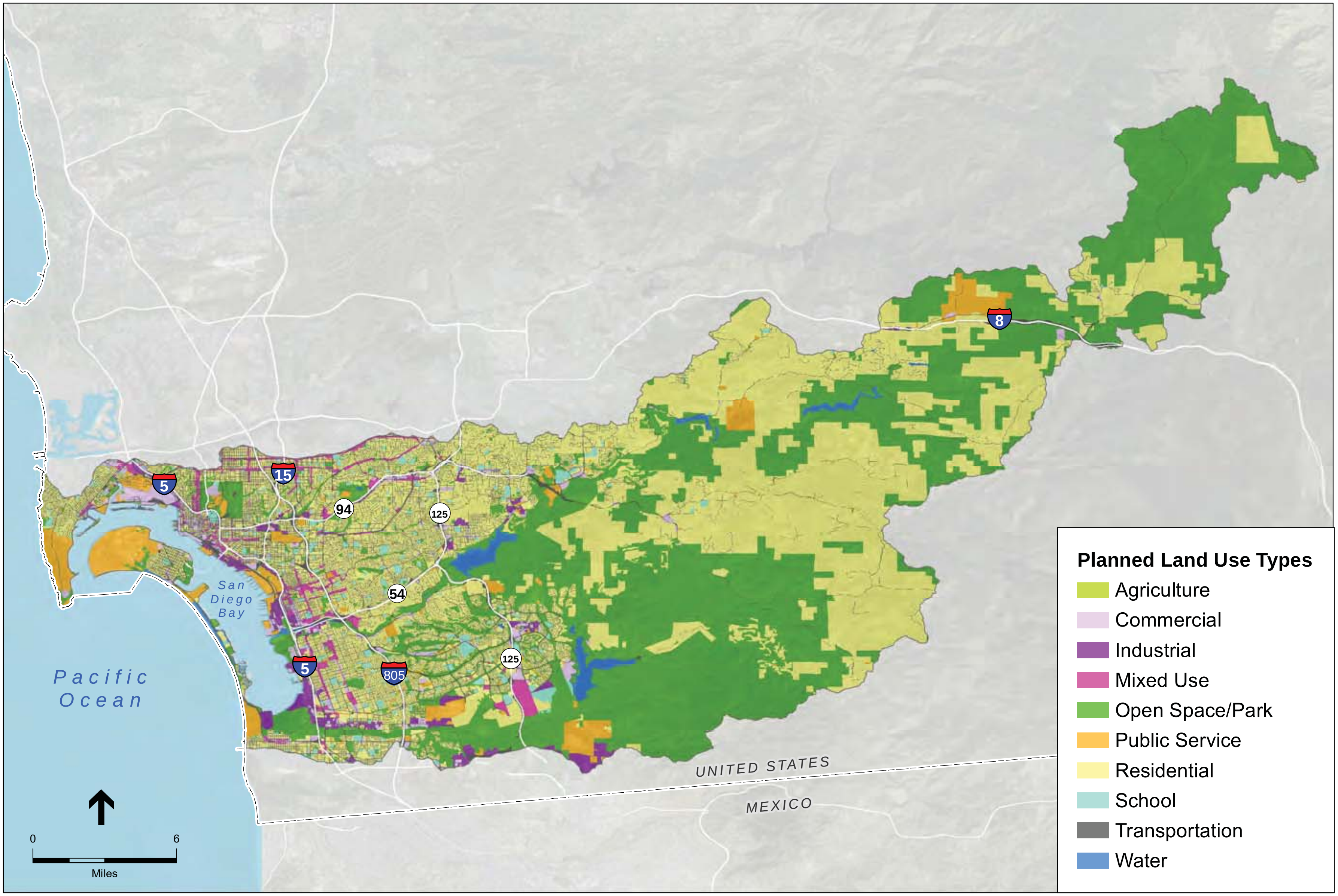


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-38**

Existing Land Use within the San Diego Bay Water Management Area

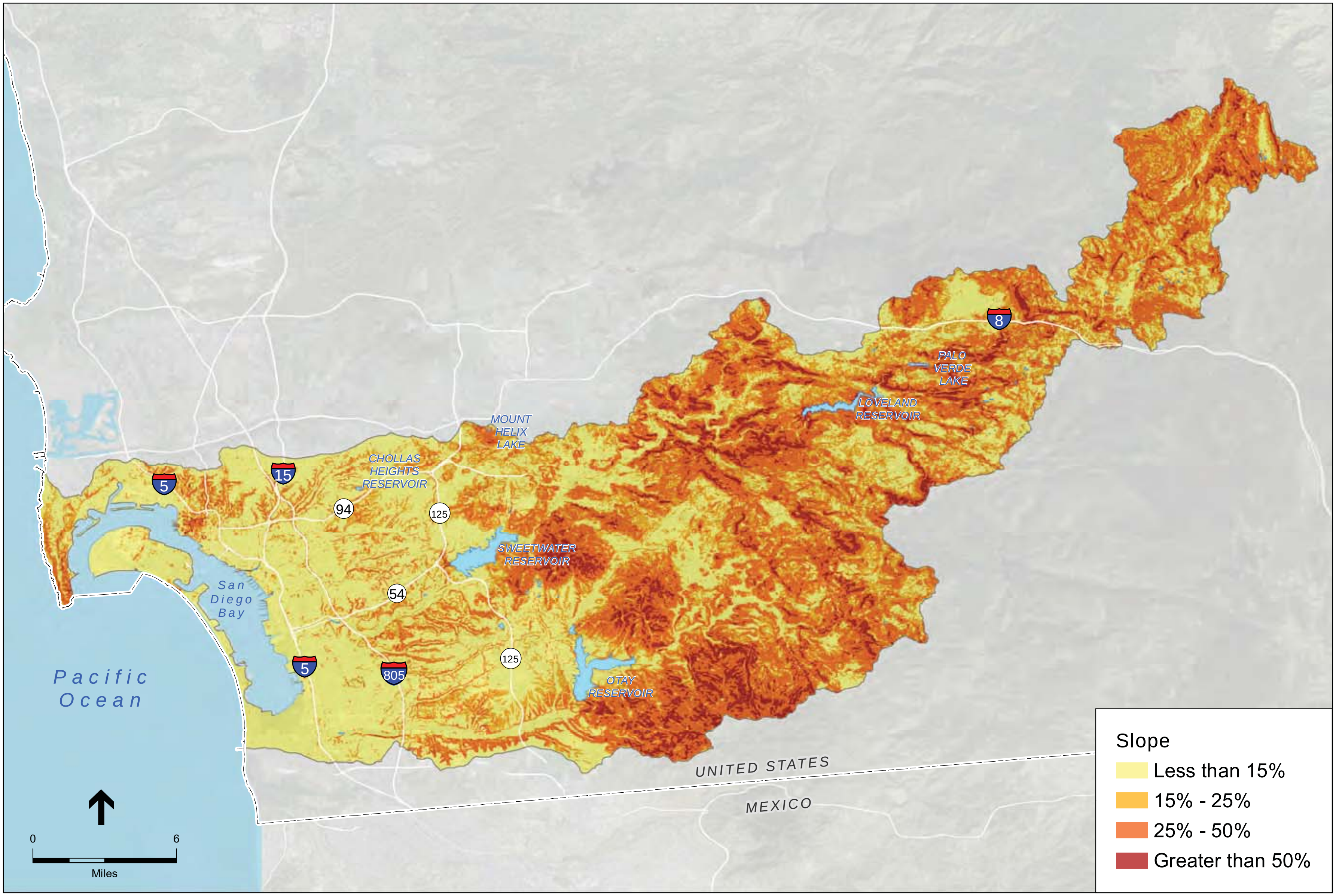


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-39

Planned Land Use within the San Diego Bay Water Management Area

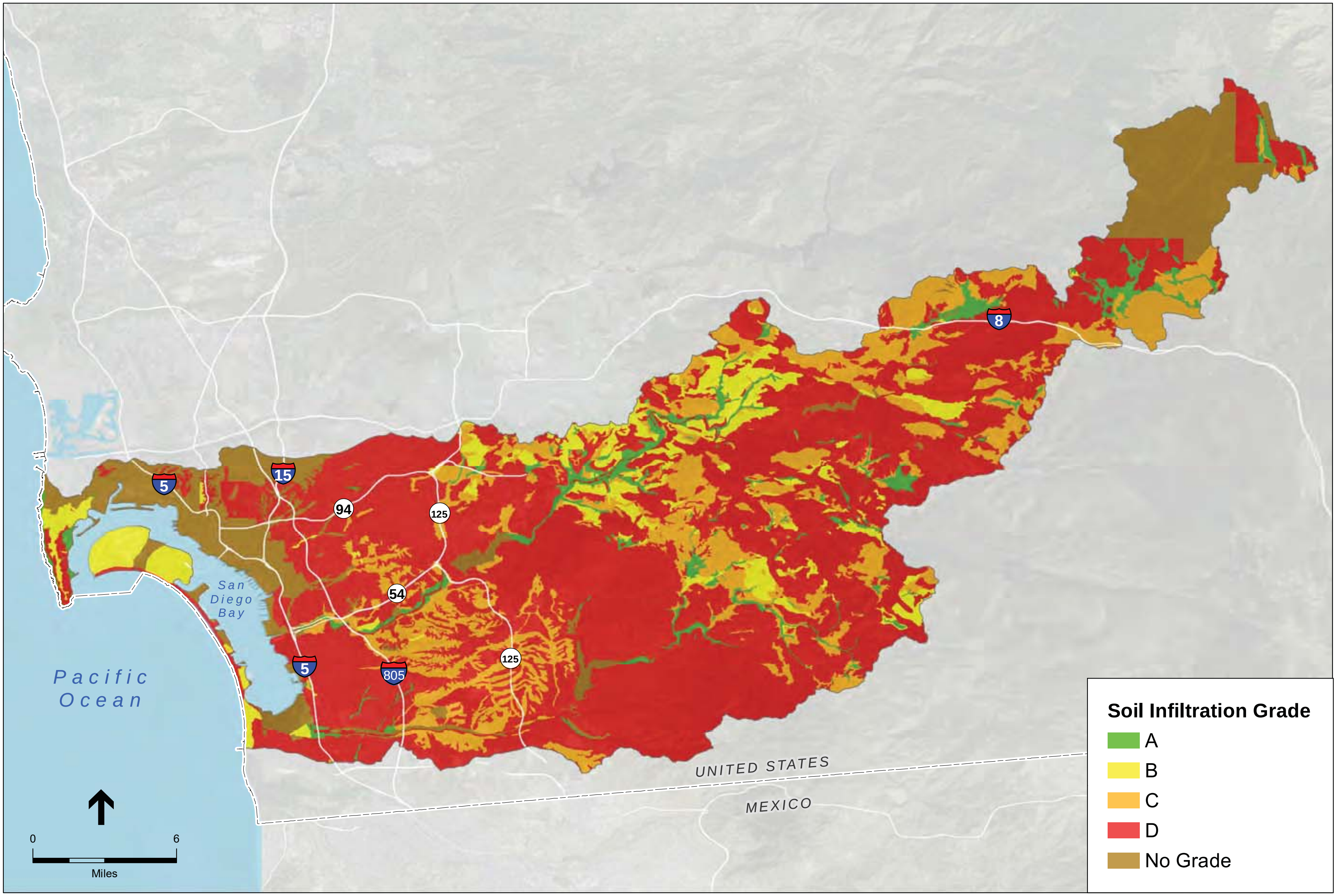


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-40**

Slope within the San Diego Bay Water Management Area

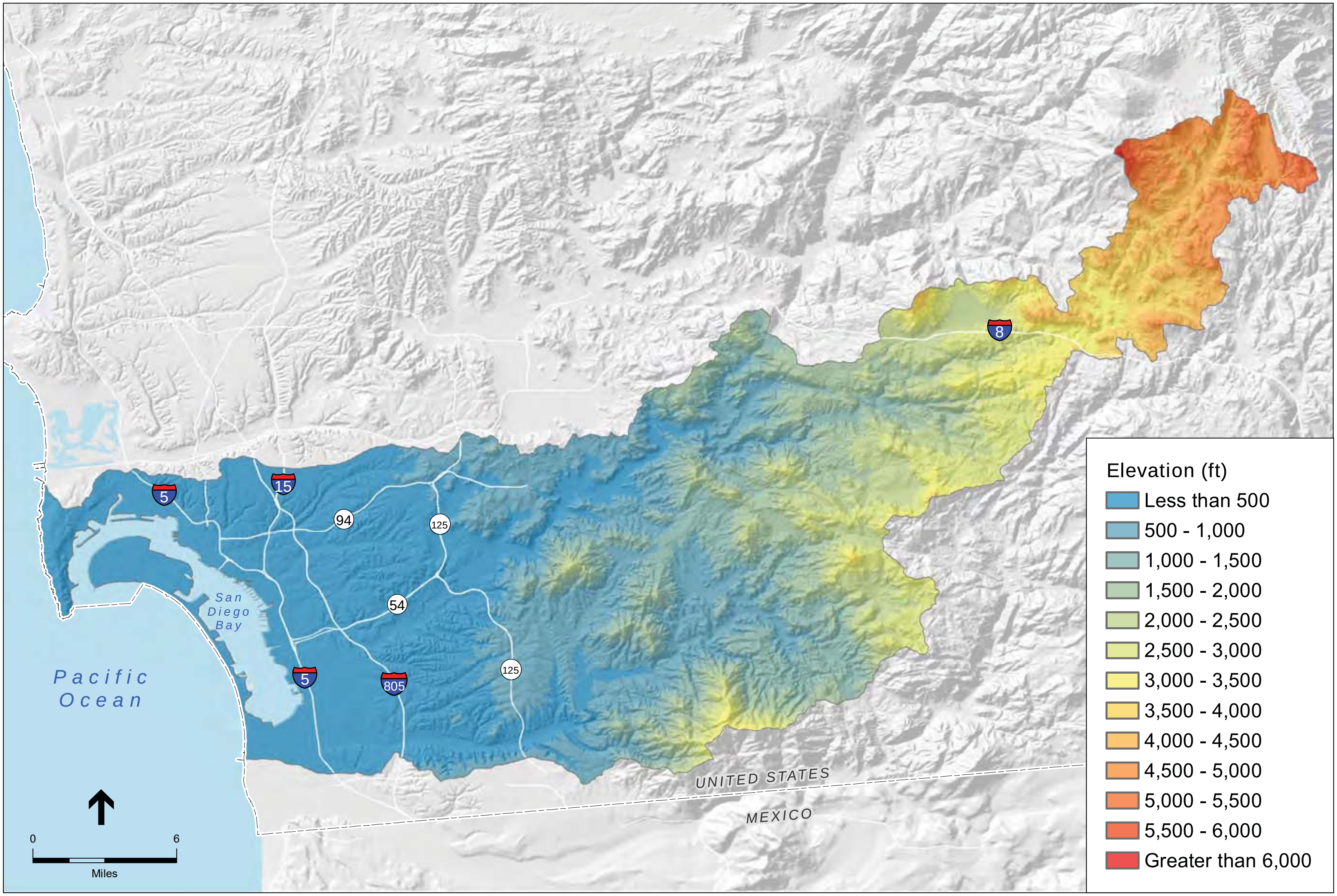


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-41

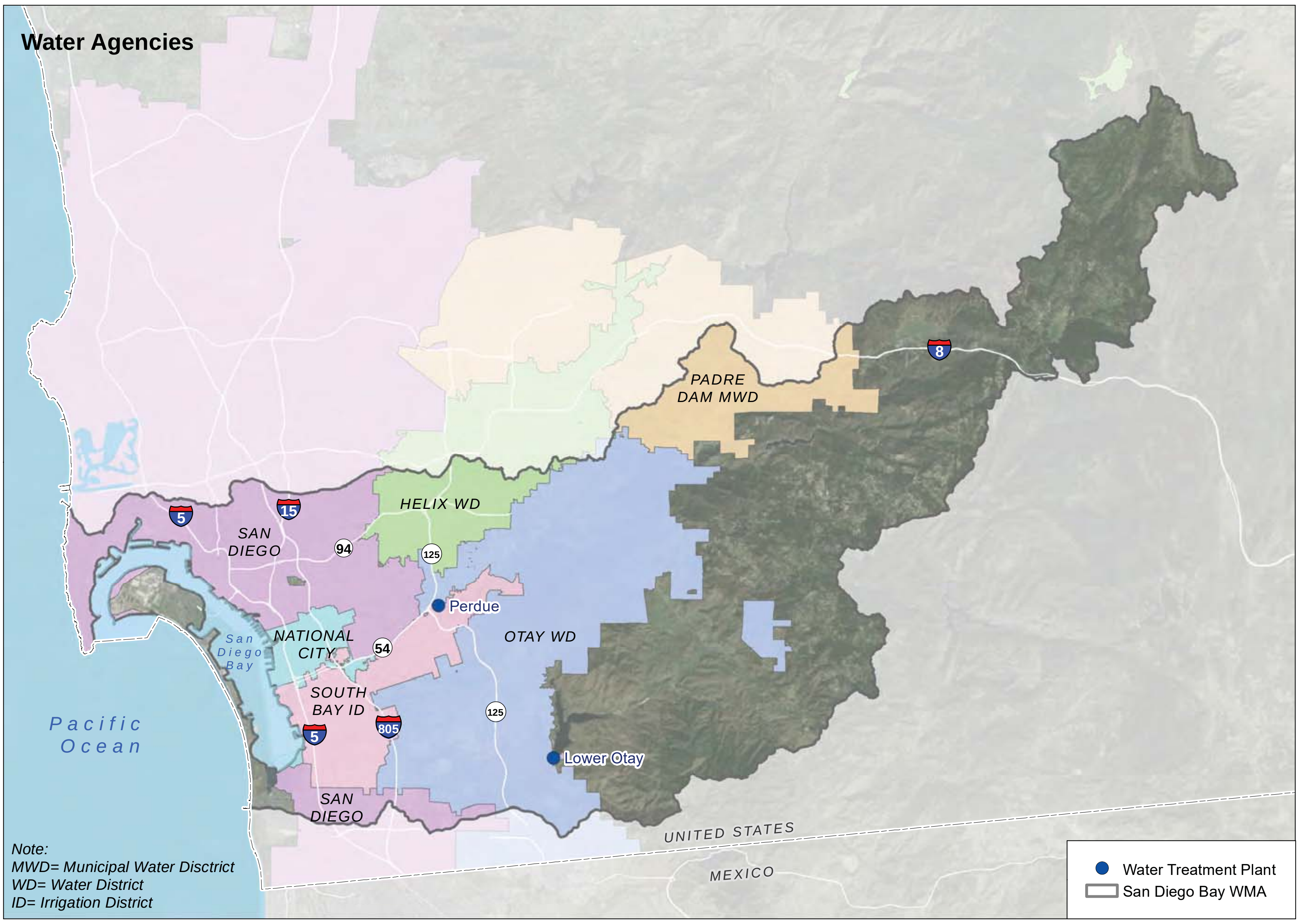
Slope within the San Diego Bay Water Management Area

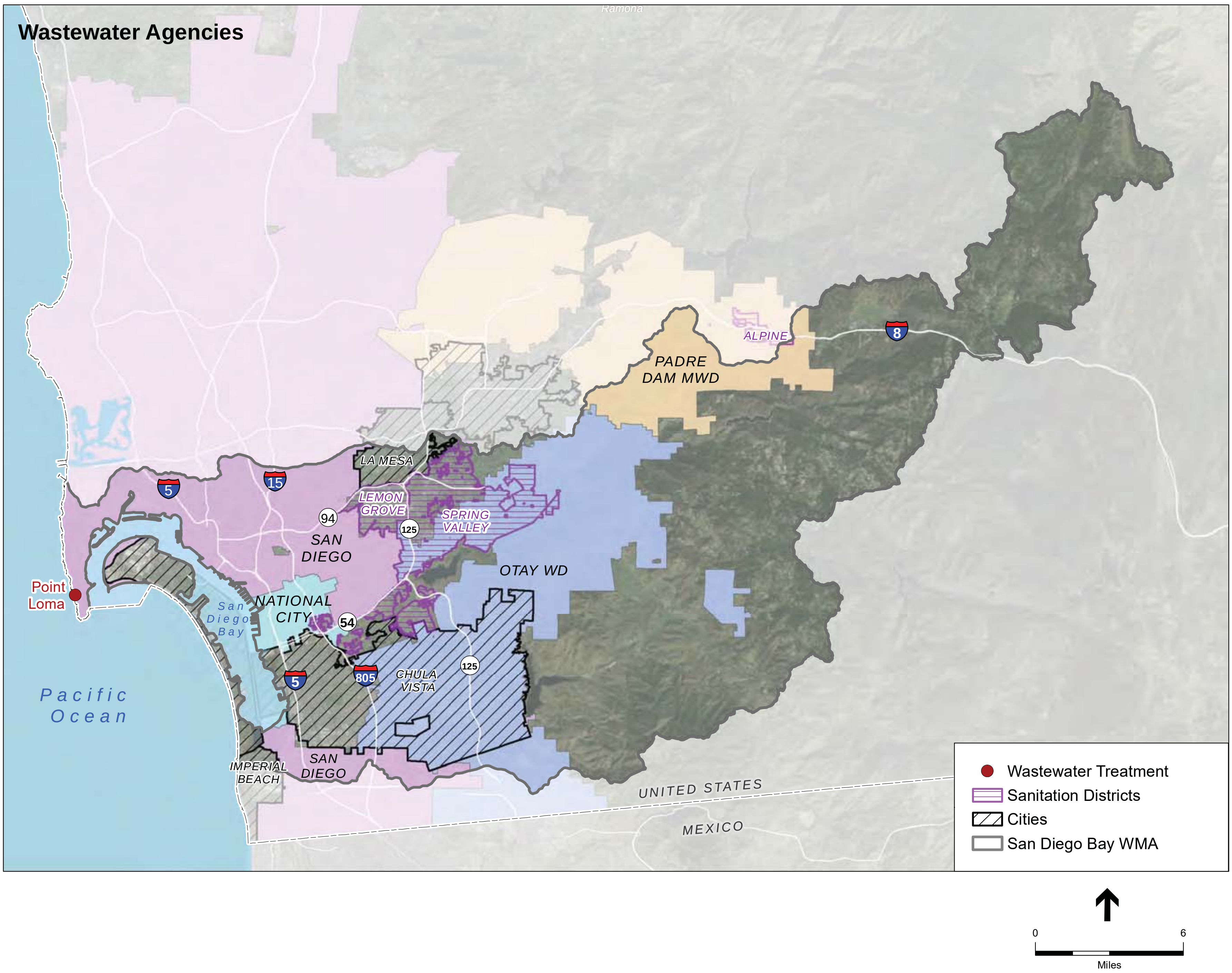


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-42**
Topography within the San Diego Bay Water Management Area

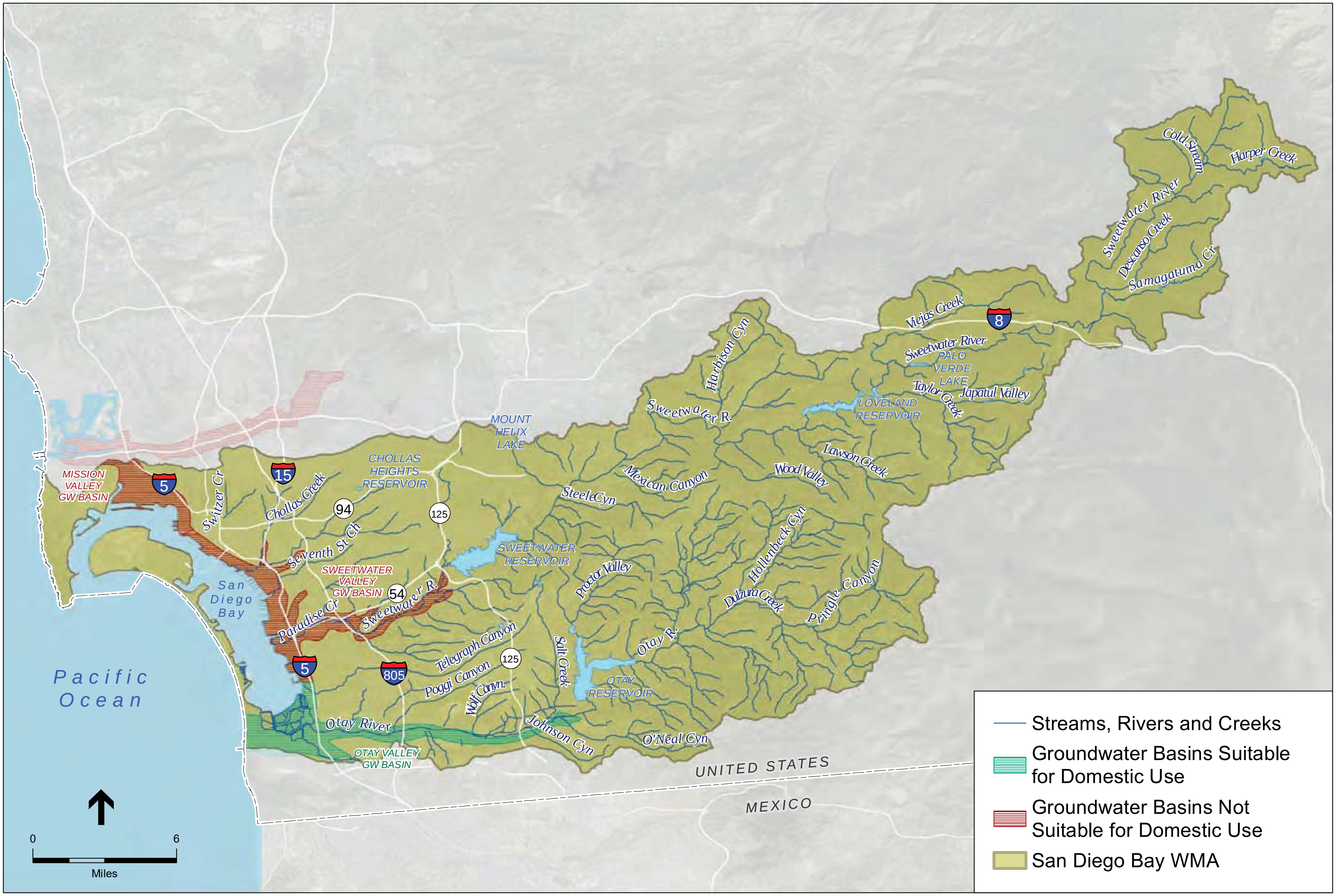




SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

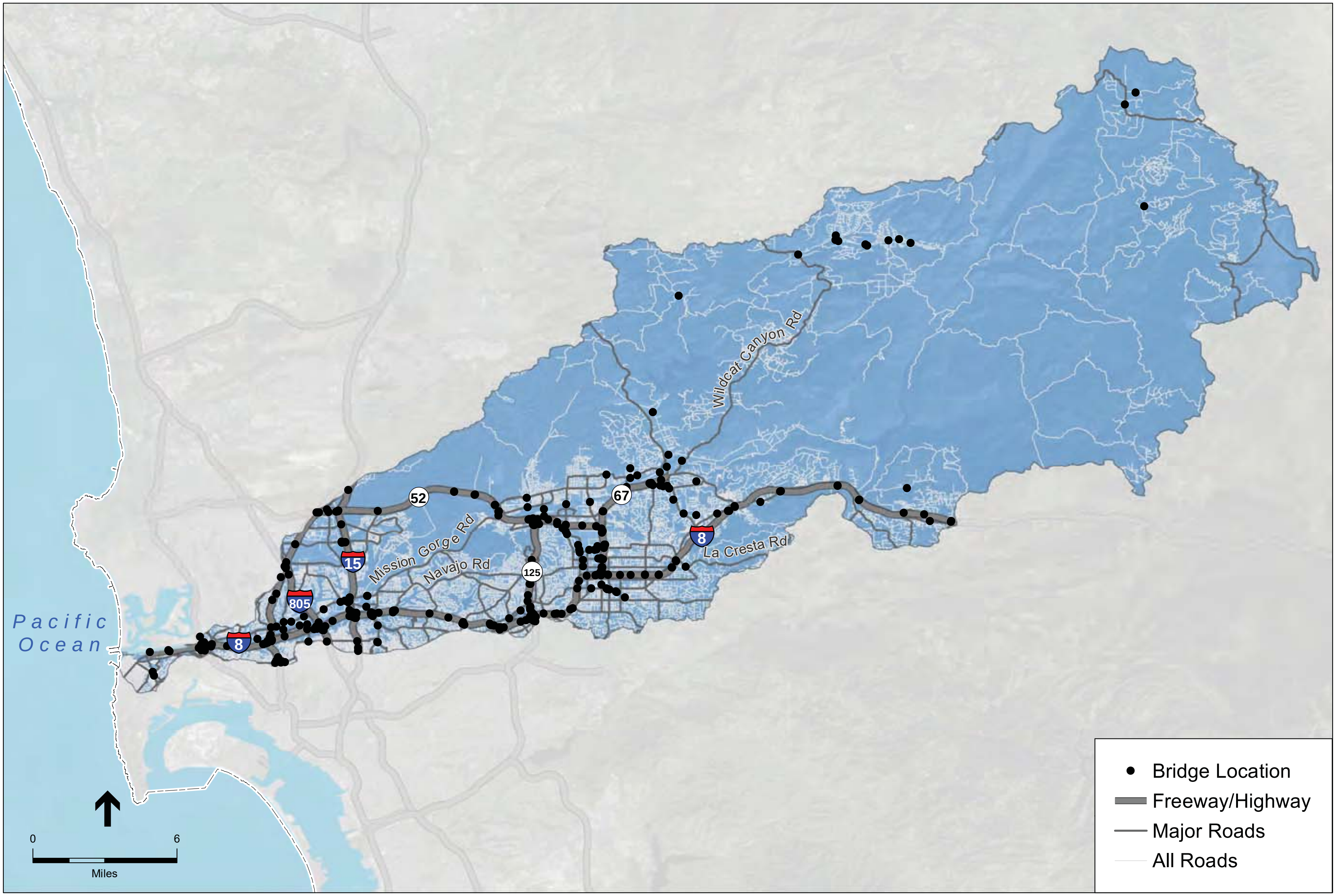
Figure B-43
Water Agencies and Wastewater Agencies
within the San Diego Bay Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-44**
Water Features within the San Diego Bay Water Management Area

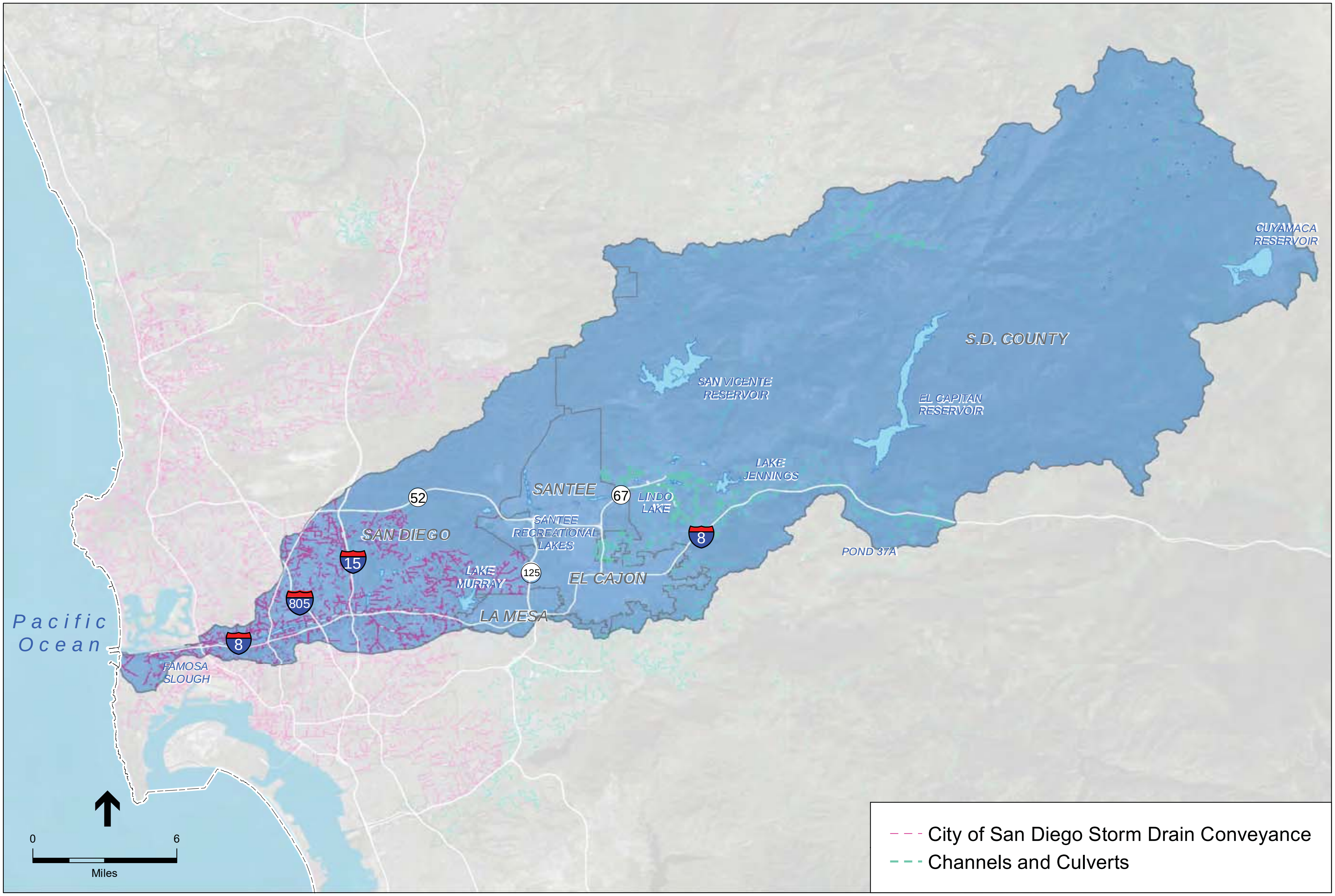


SOURCE: ESRI, 2016; SanGIS, 2016; Caltrans

SCFS . 140075.20

Figure B-45

Built Environments within the San Diego River Water Management Area

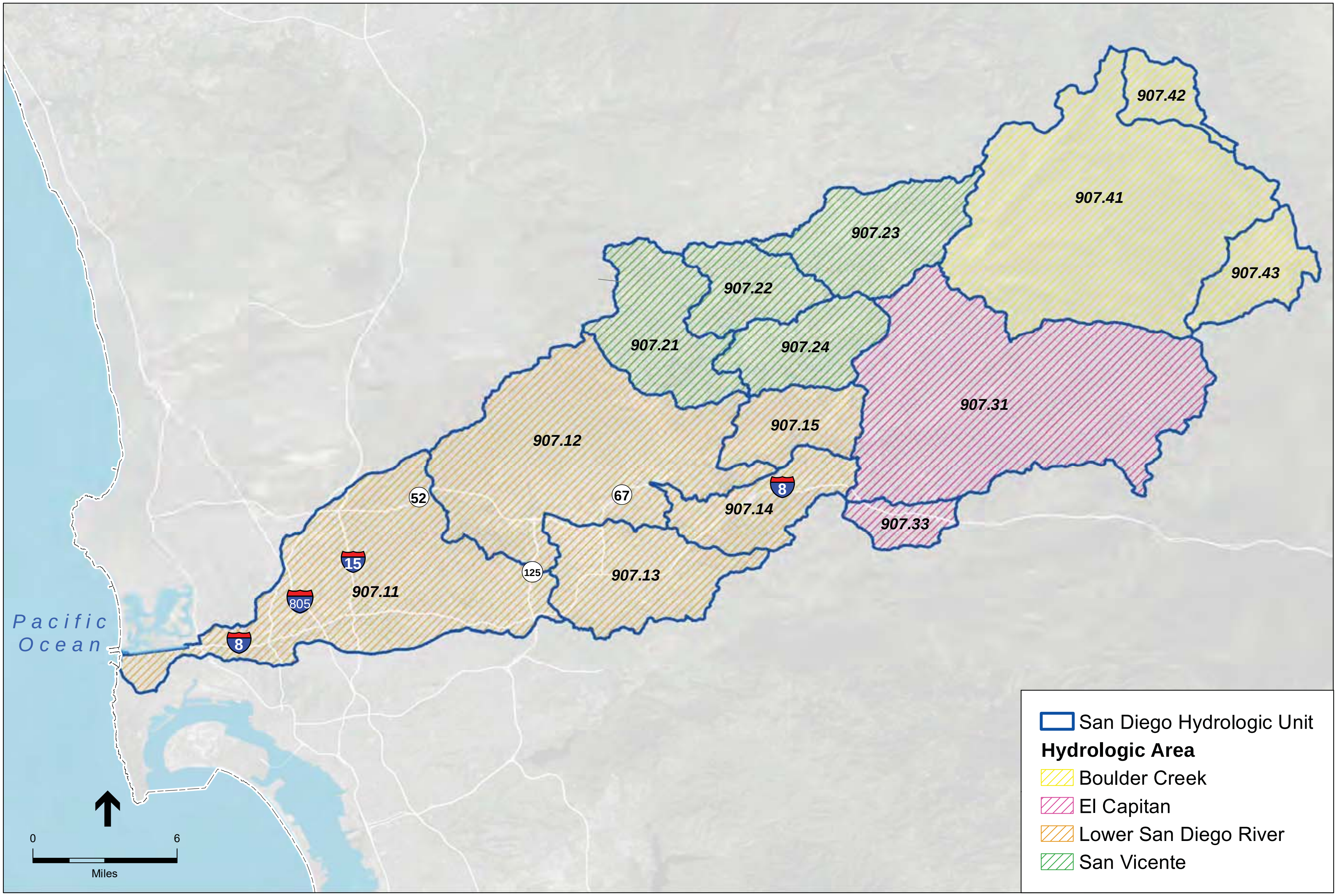


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-46**

Flood Control System within the San Diego River Water Management Area

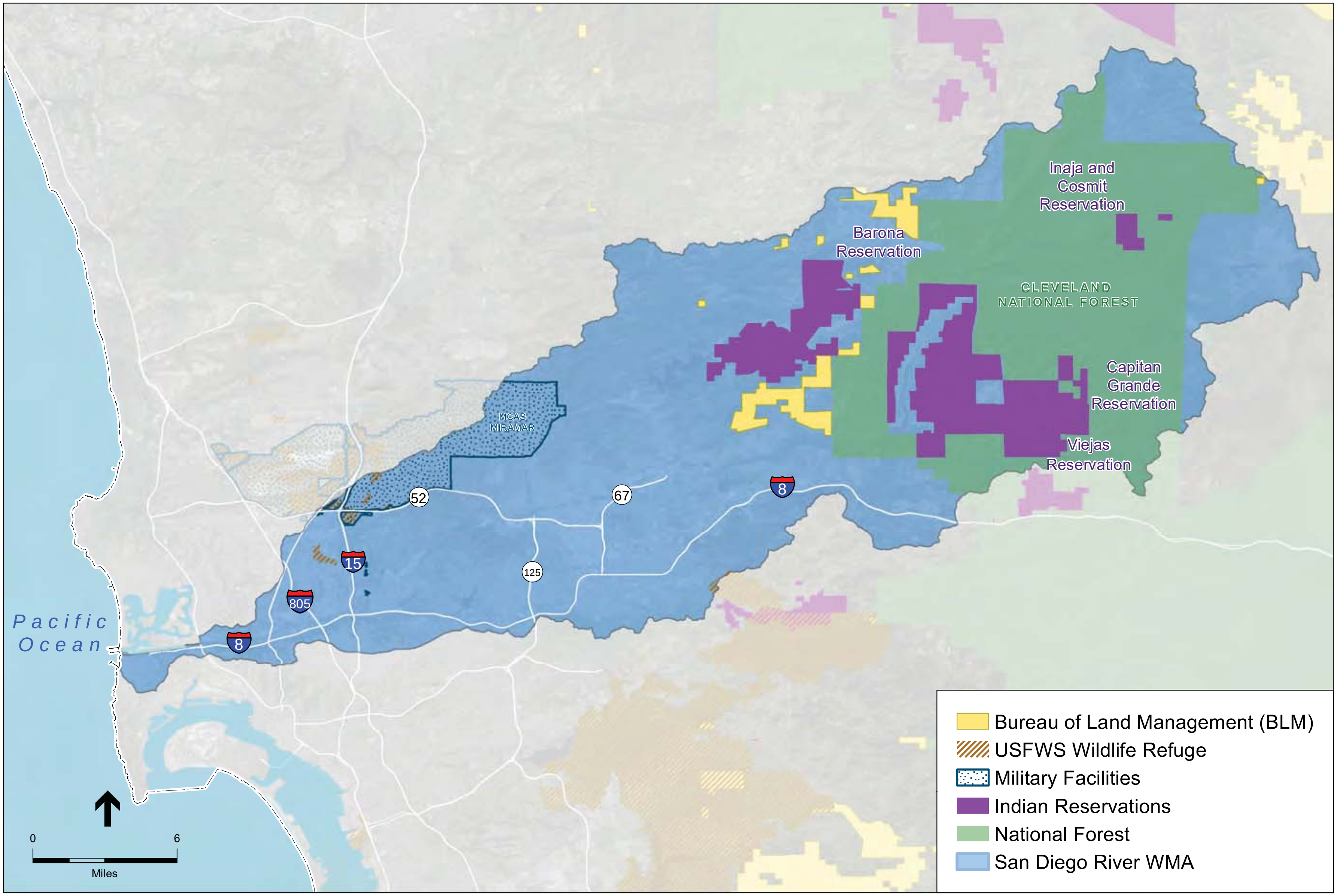


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-47

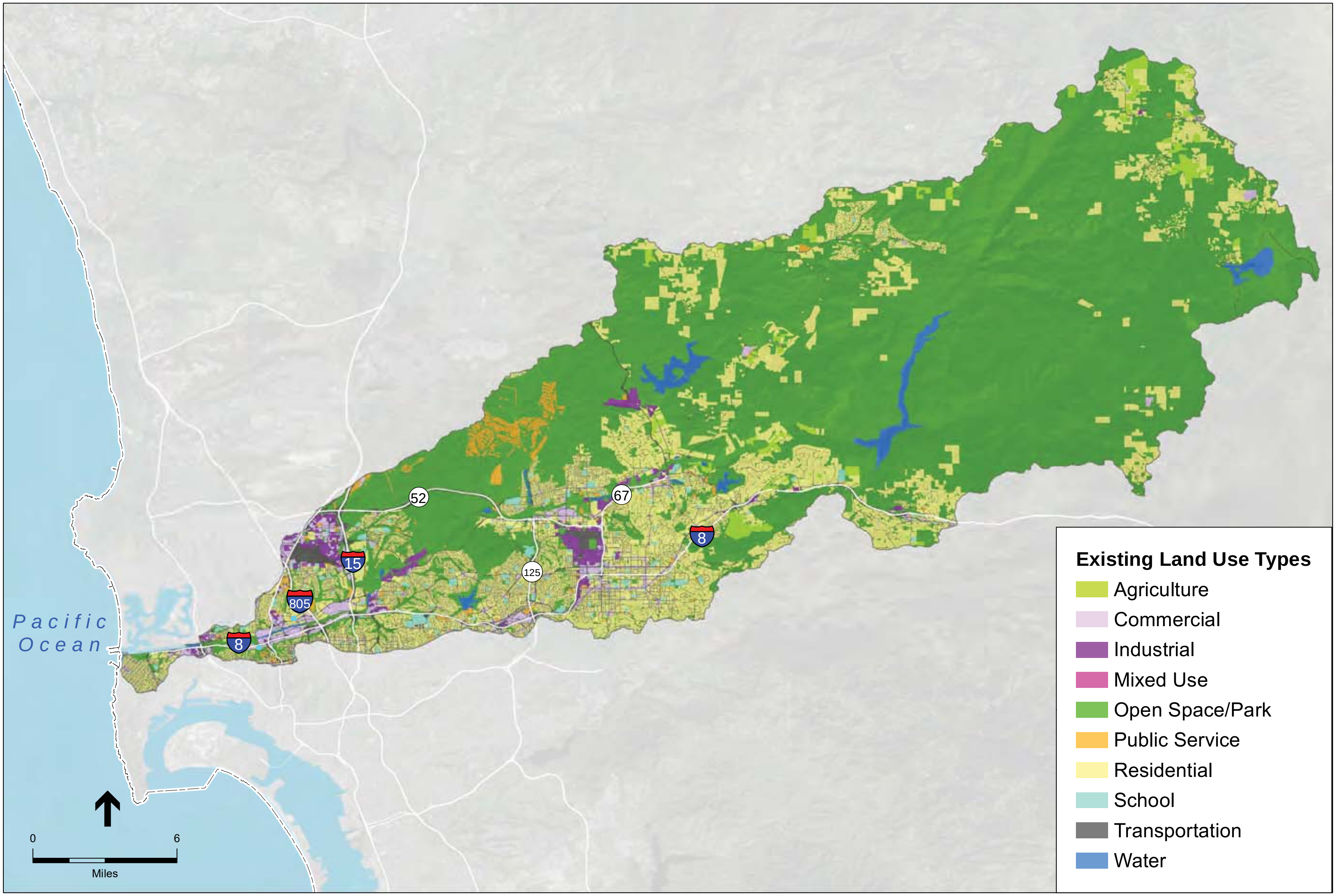
Hydrologic Units and Areas within the San Diego River Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-48**
Land Use Agencies within the San Diego River Water Management Area

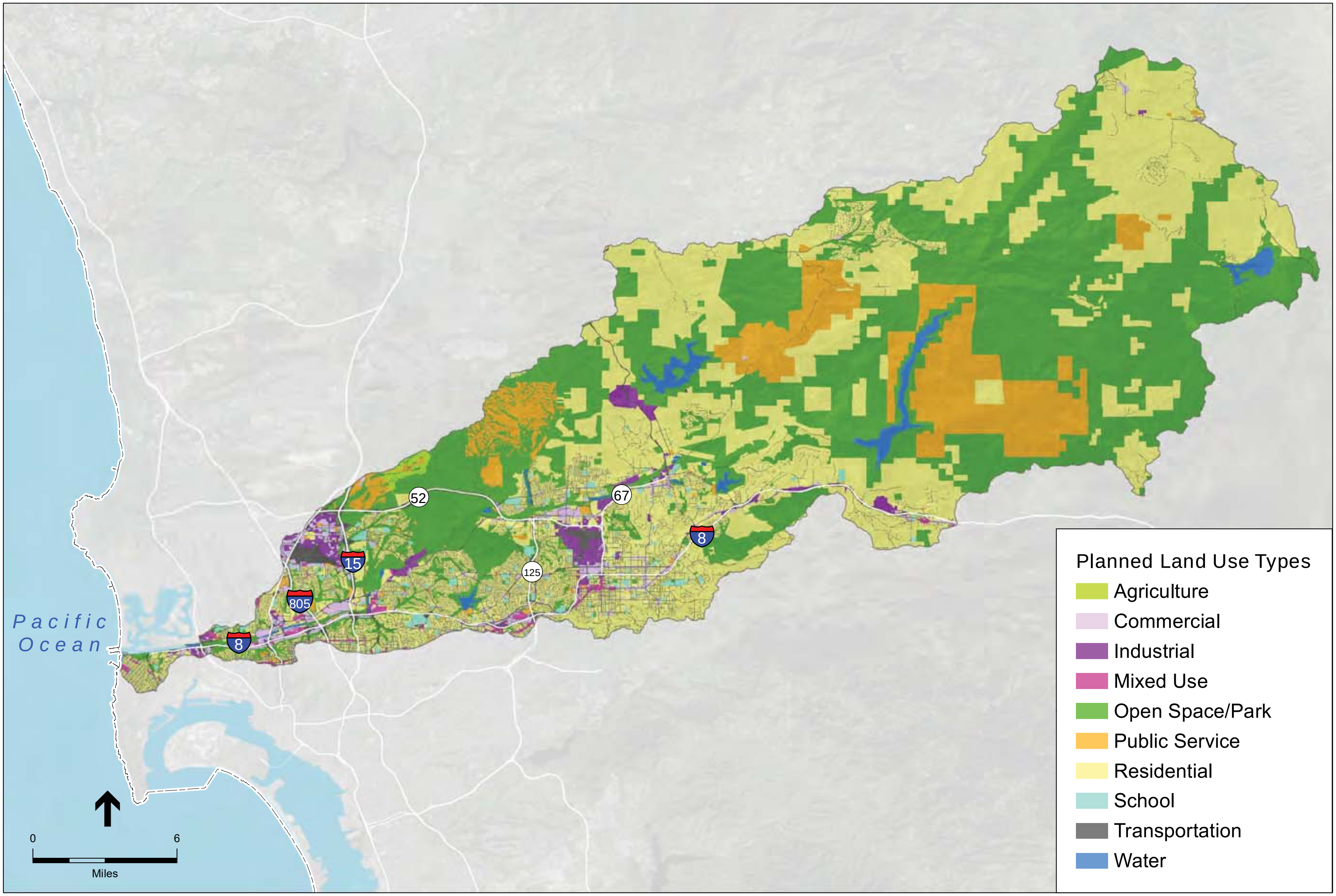


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-49

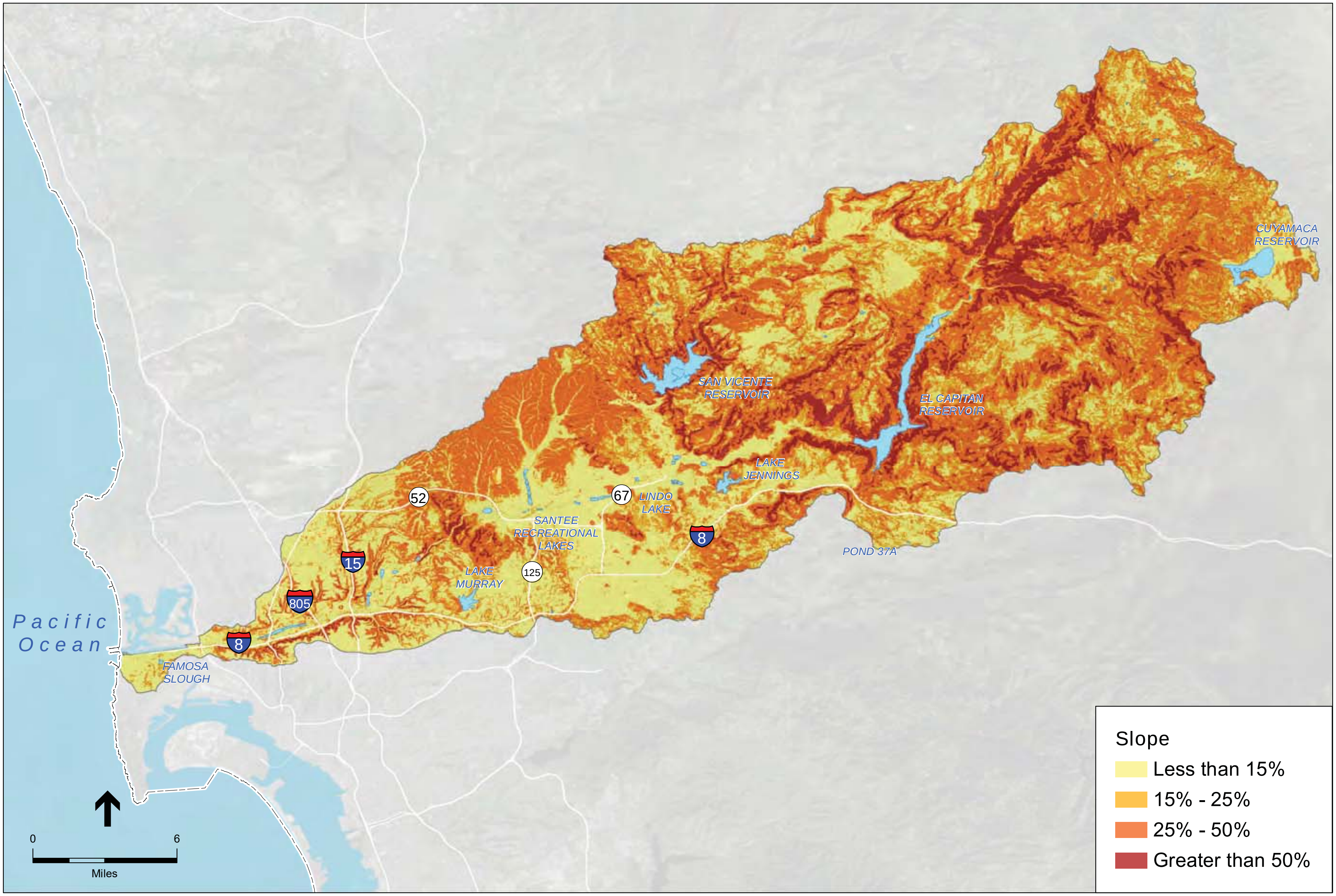
Existing Land Use within the San Diego River Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-50**
Planned Land Use within the San Diego River Water Management Area

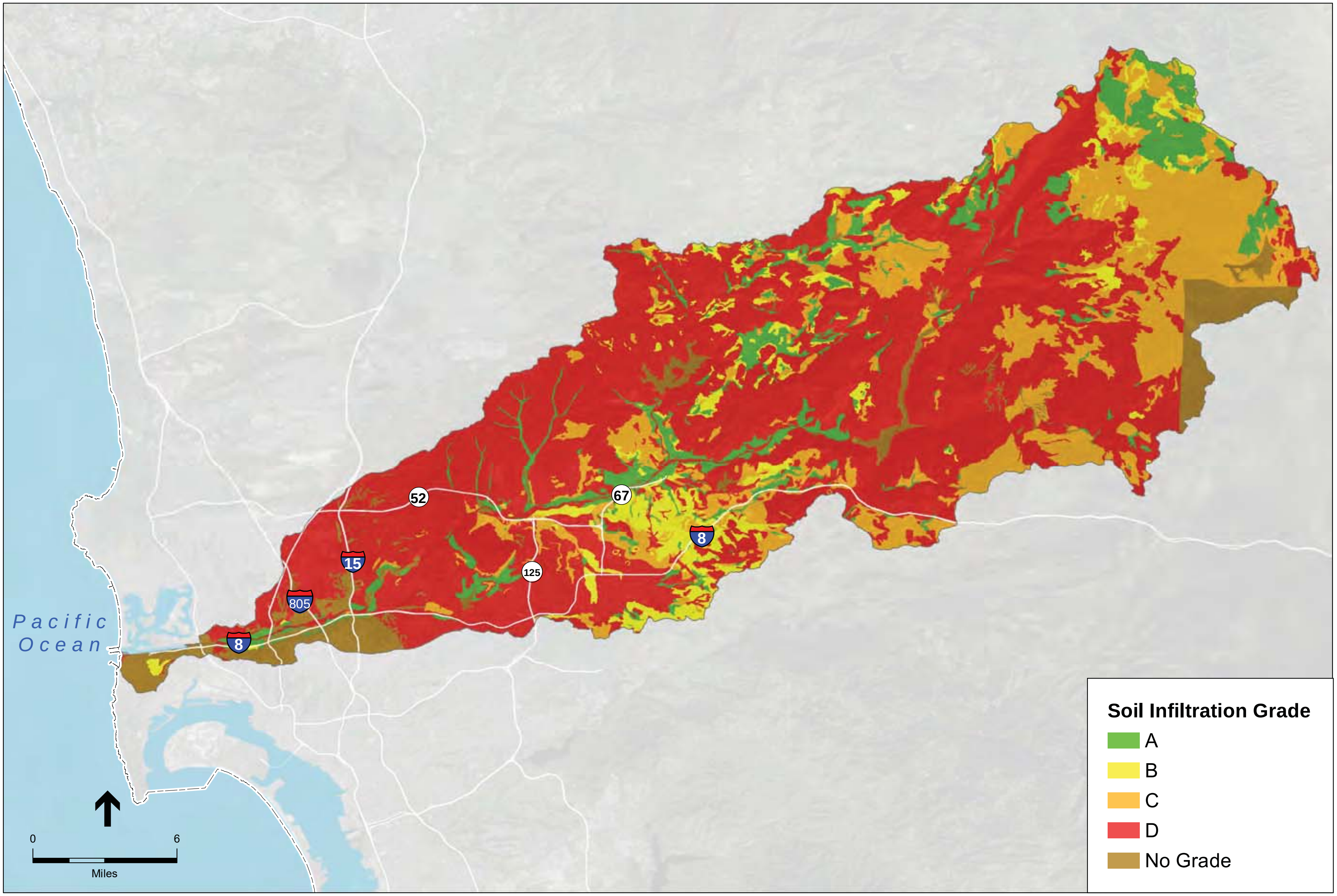


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-51**

Slope within the San Diego River Water Management Area

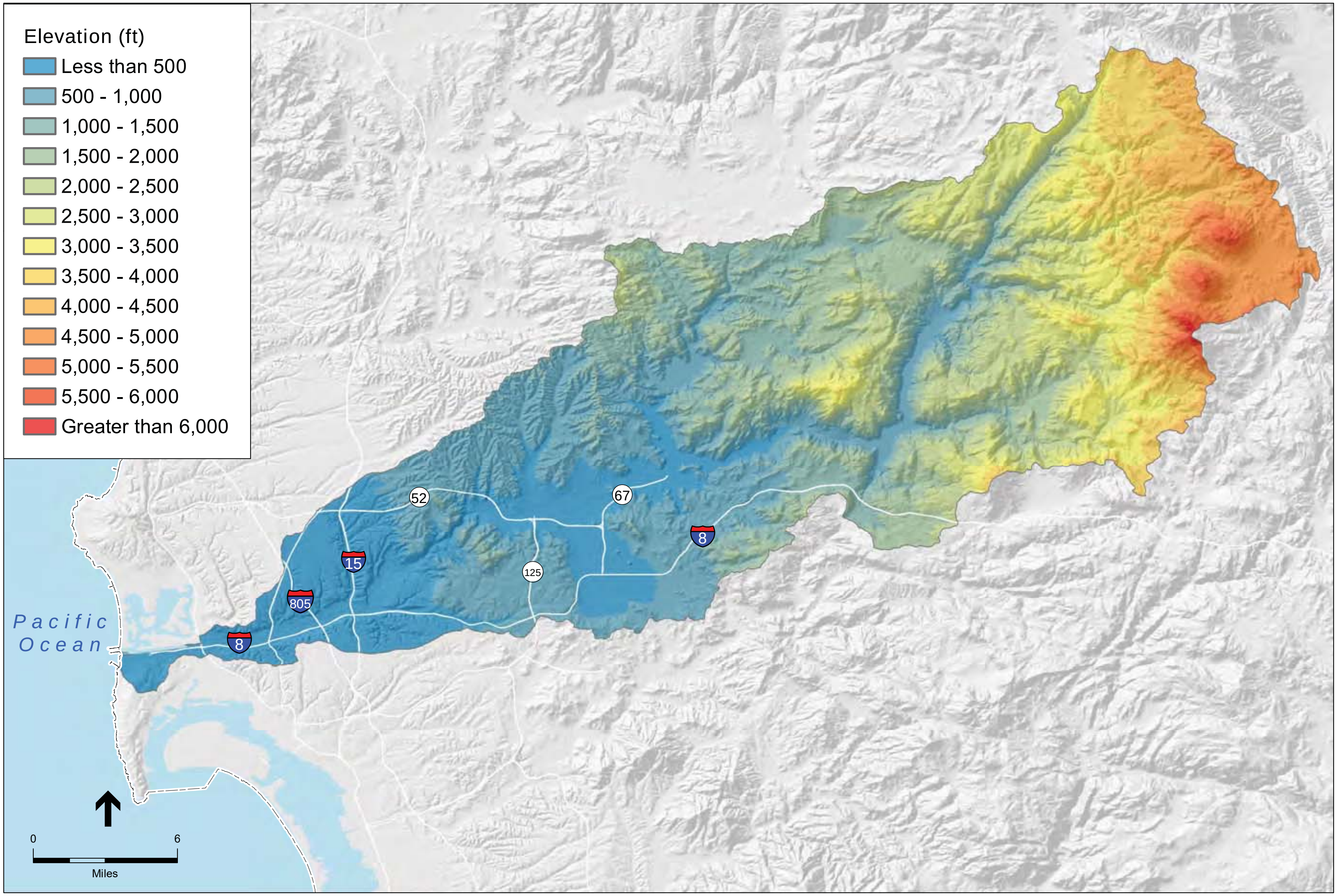


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-52

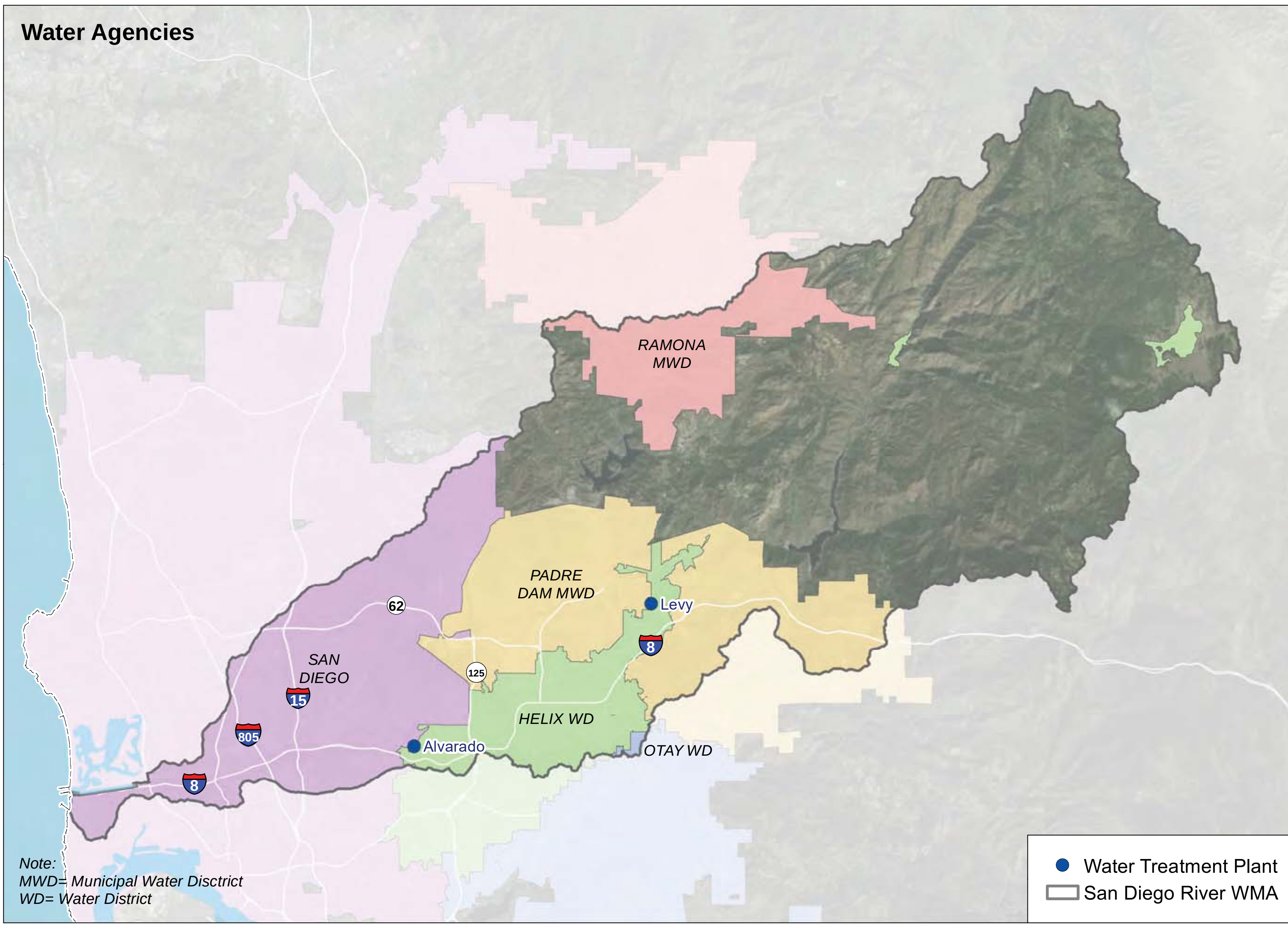
Soils within the San Diego River Water Management Area

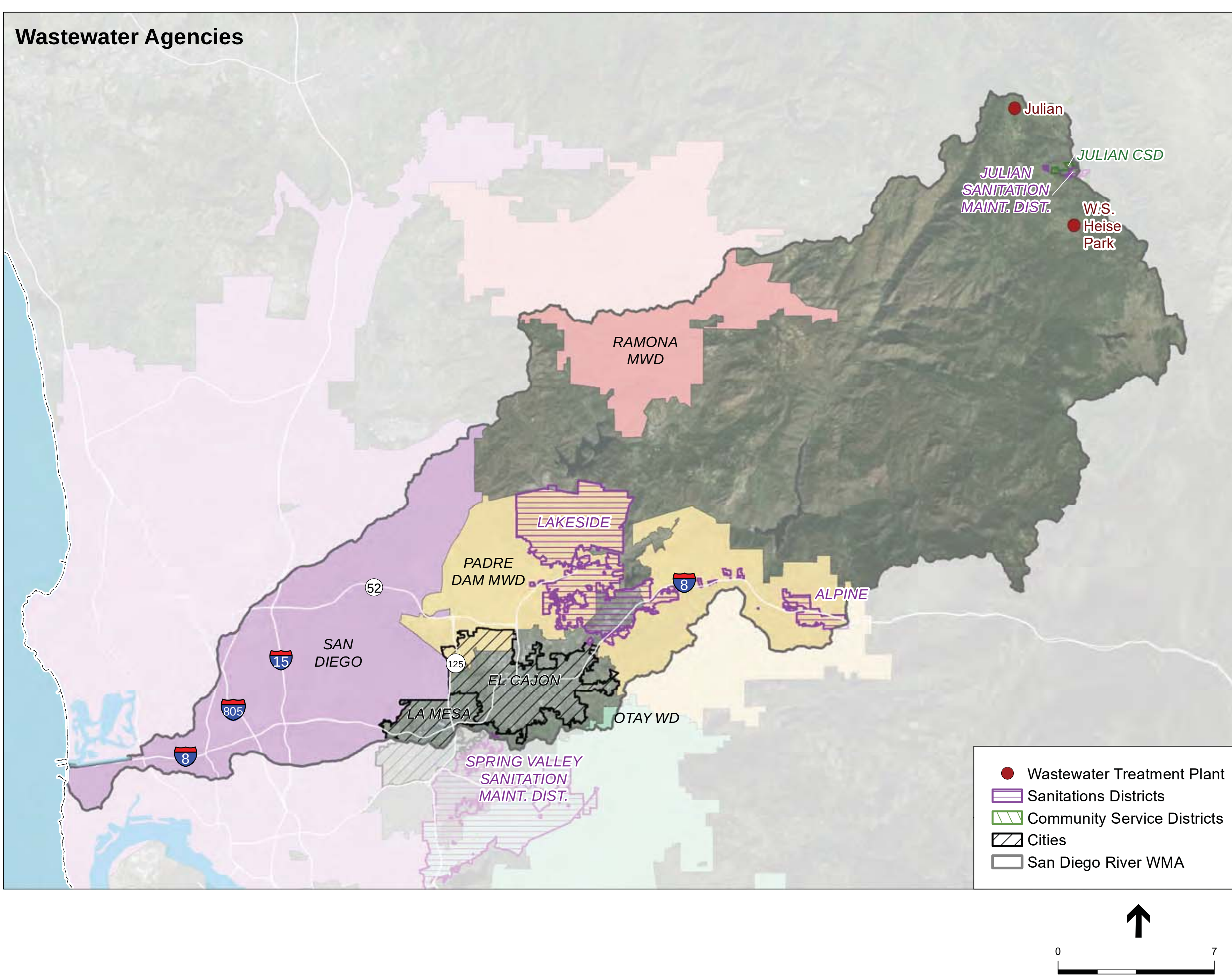


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-53**
Slope within the San Diego River Water Management Area

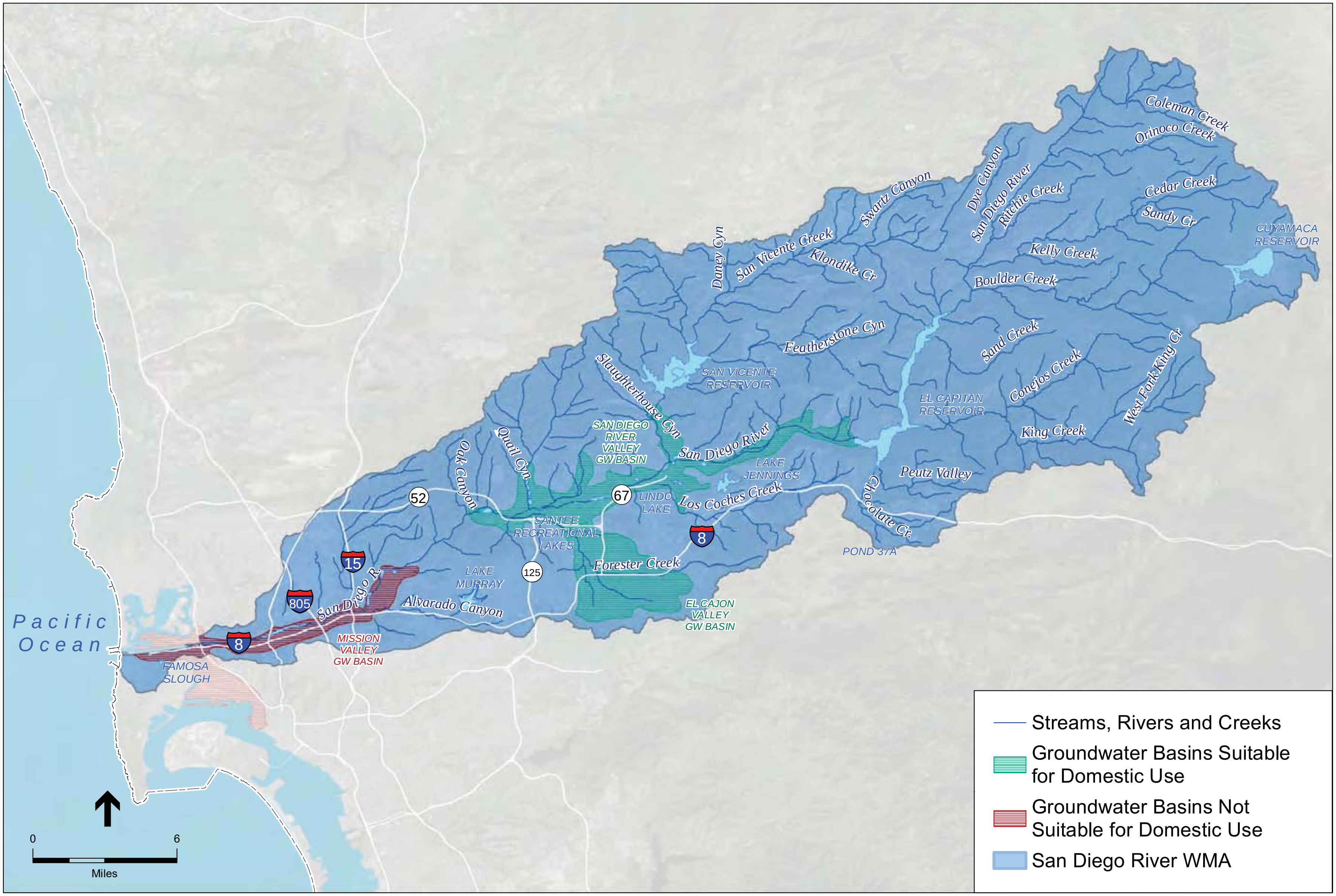




SOURCE: ESRI, 2016; SanGIS, 2016; IRWM, 2016

SCFS . 140075.20

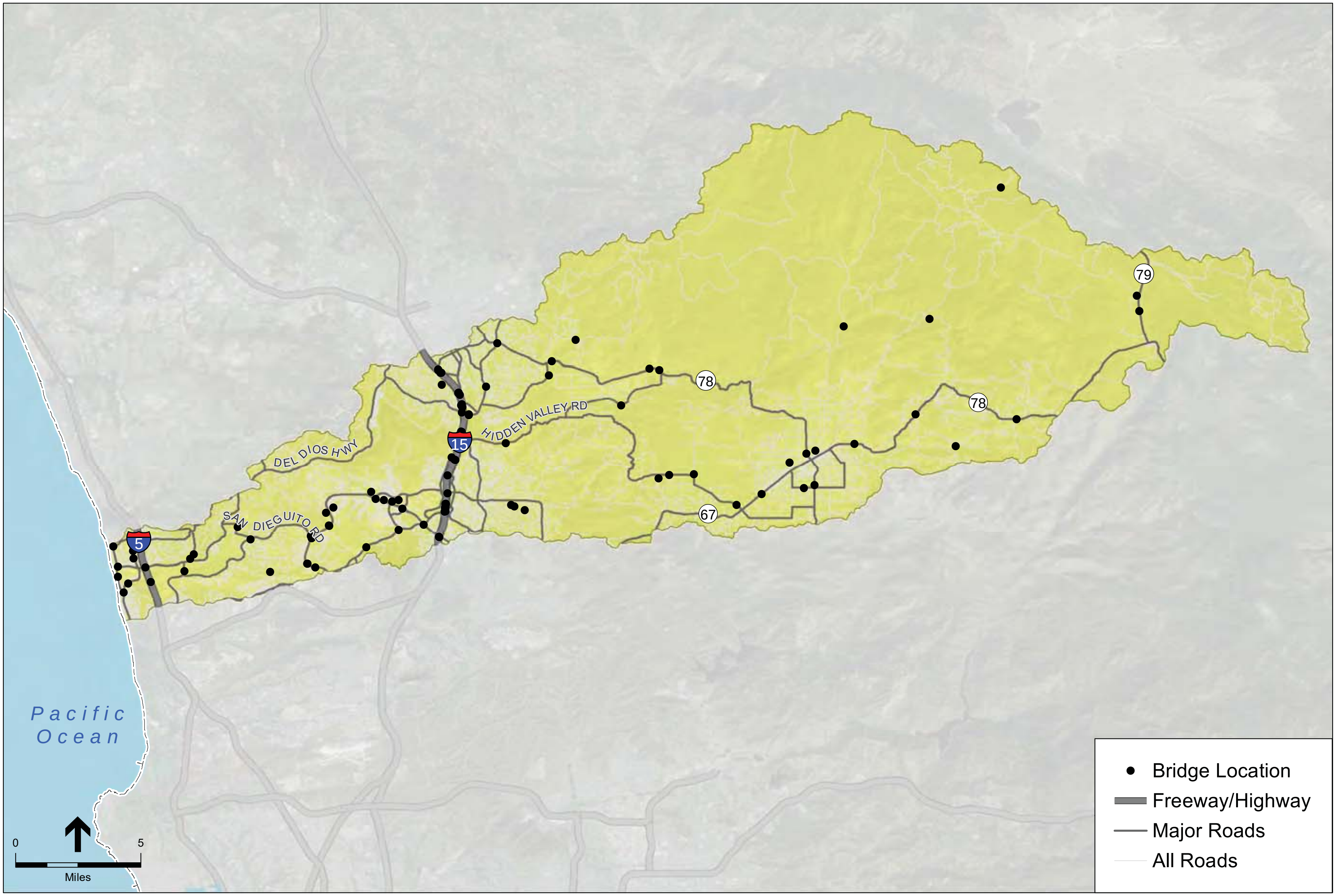
Figure B-54
Water Agencies and Wastewater Agencies within the San Diego River Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

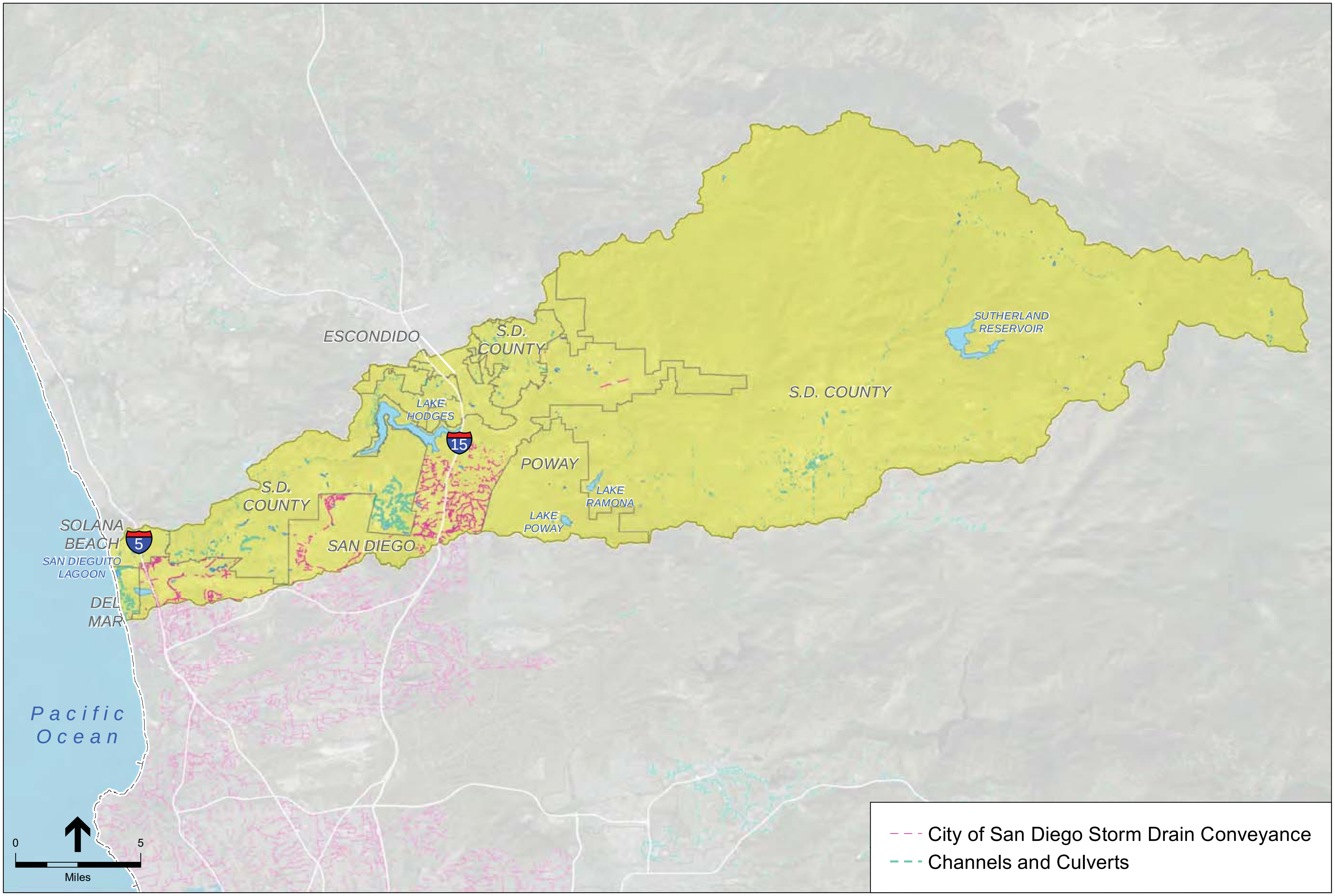
Figure **B-55**
Water Features within the San Diego River Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-56**
Built Environments within the San Dieguito Water Management Area

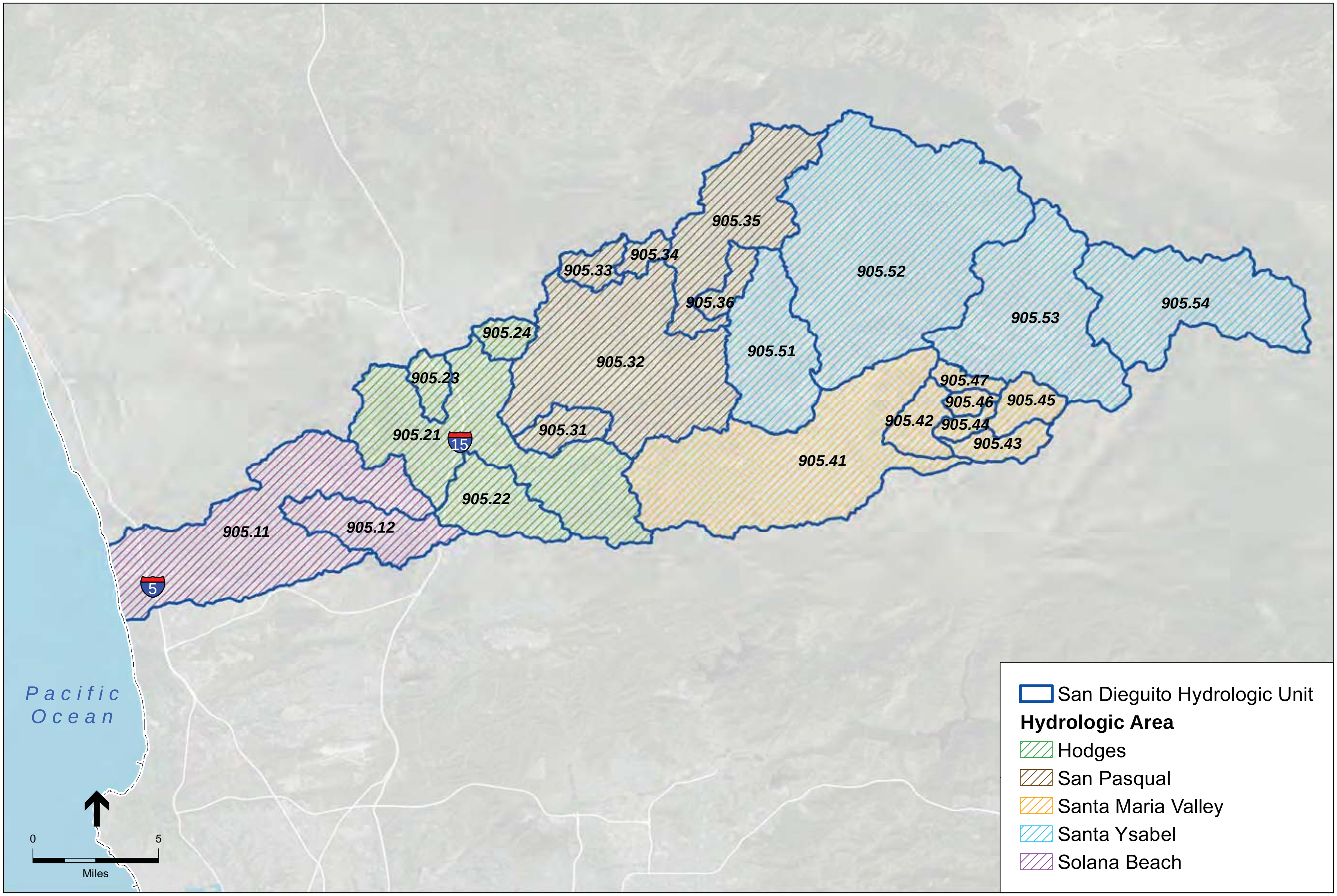


SOURCE: ESRI, 2016; SanGIS, 2016; City of Solana Beach, 2016; City of Del Mar, 2016

SCFS . 140075.20

Figure **B-57**

Flood Control System within the San Dieguito Water Management Area

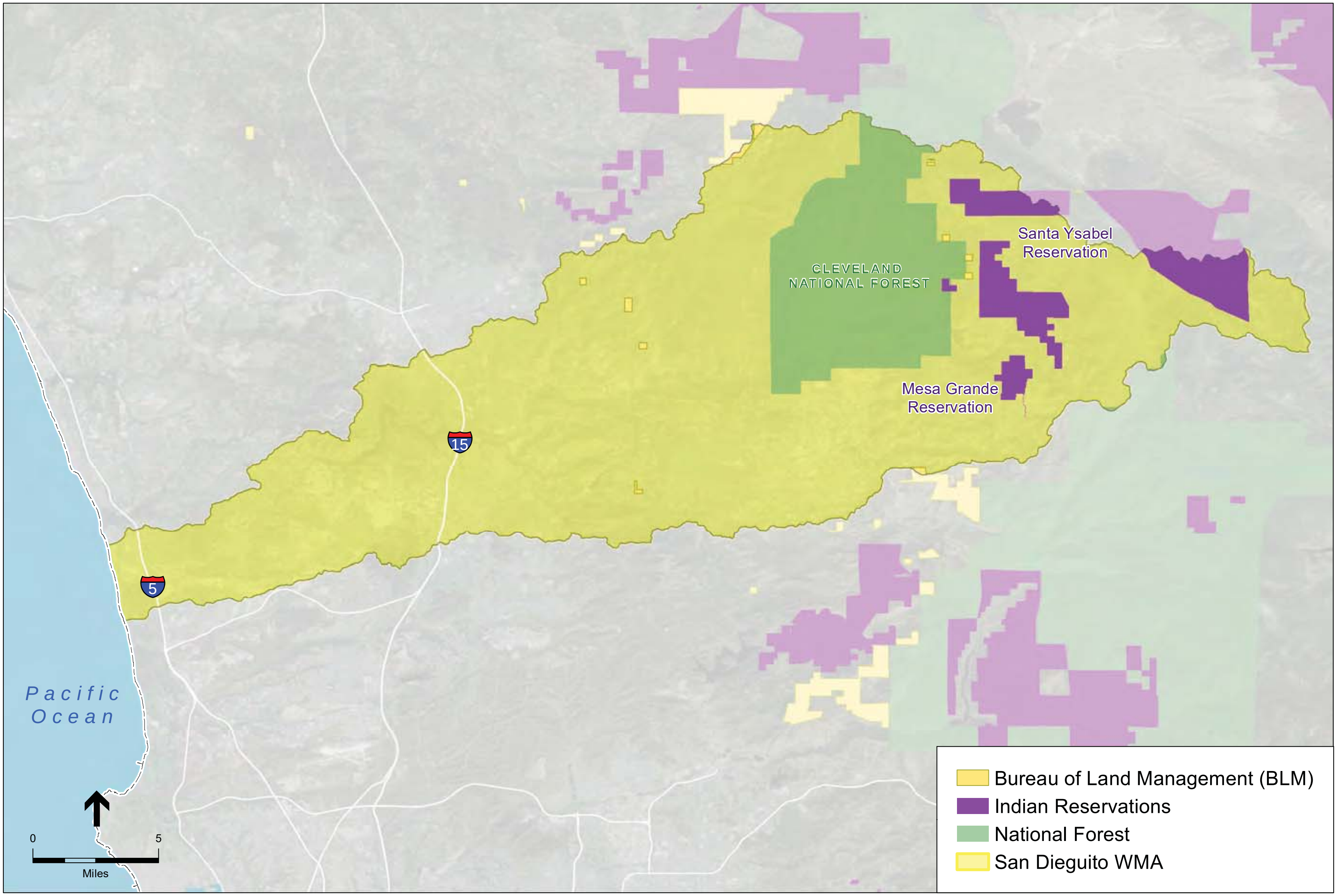


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-58

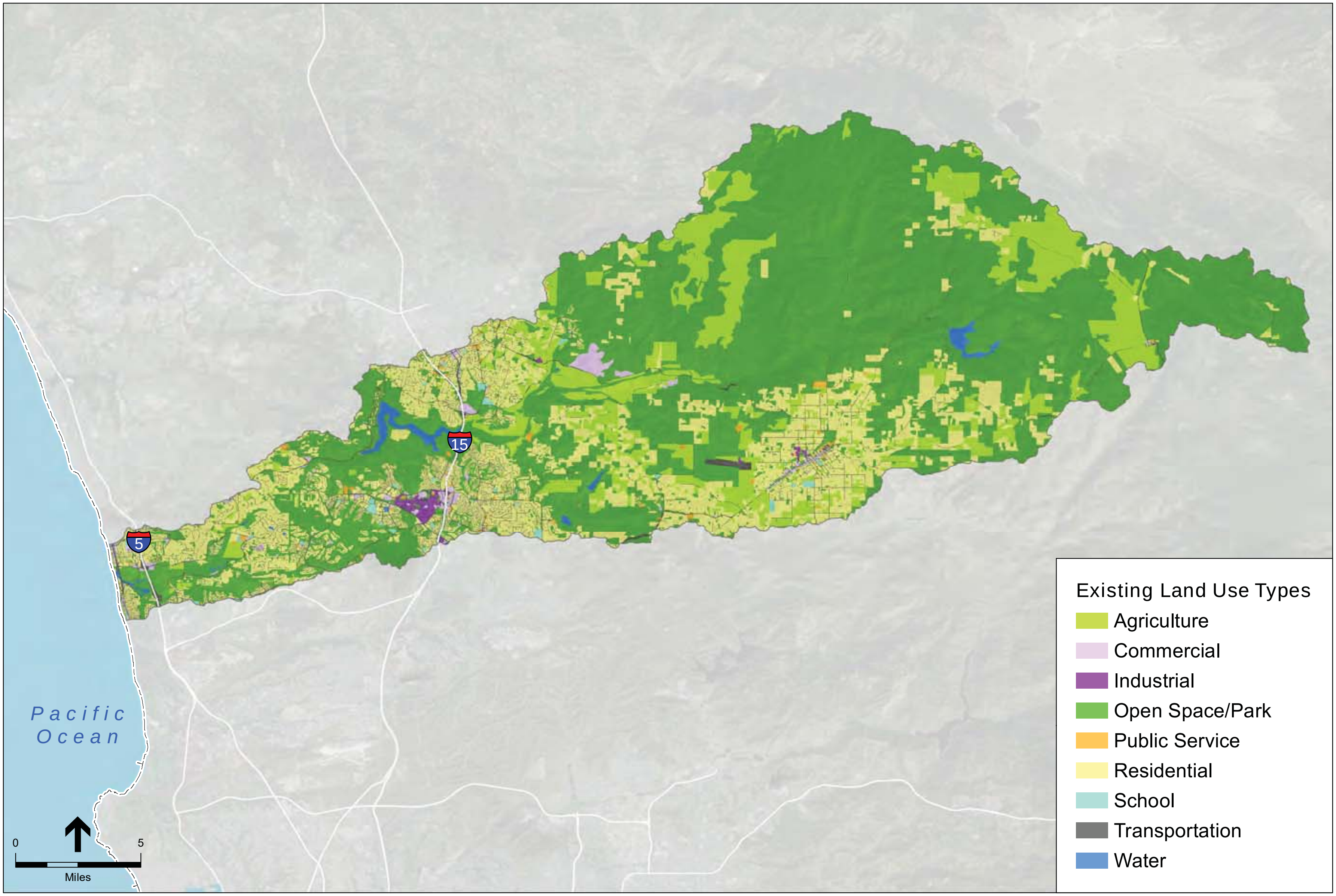
Hydrologic Units and Areas within the San Dieguito Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016; Bureau of Land Management

SCFS . 140075.20

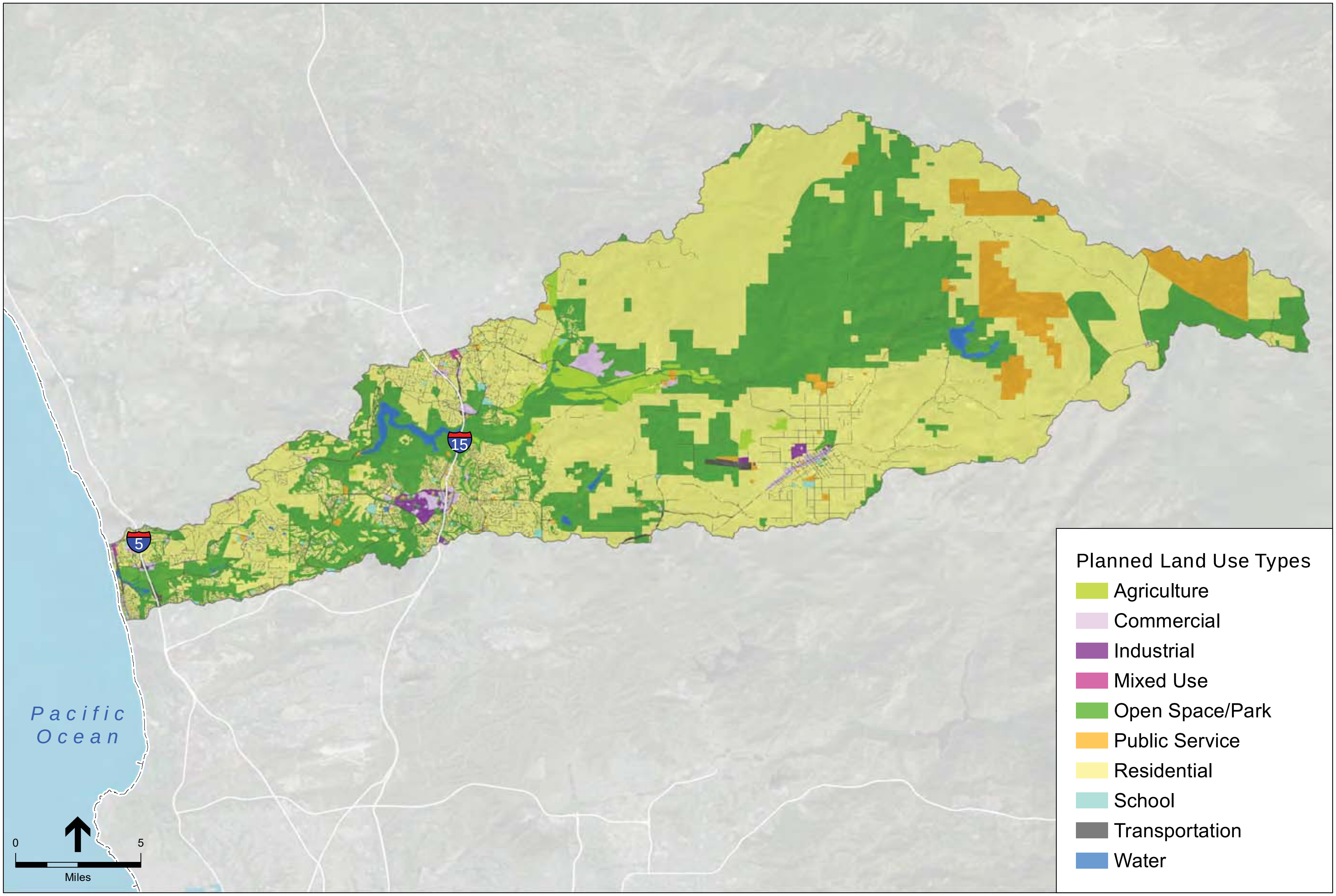
Figure B-59
Land Use Agencies within the San Dieguito Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-60**
Slope within the San Dieguito Water Management Area

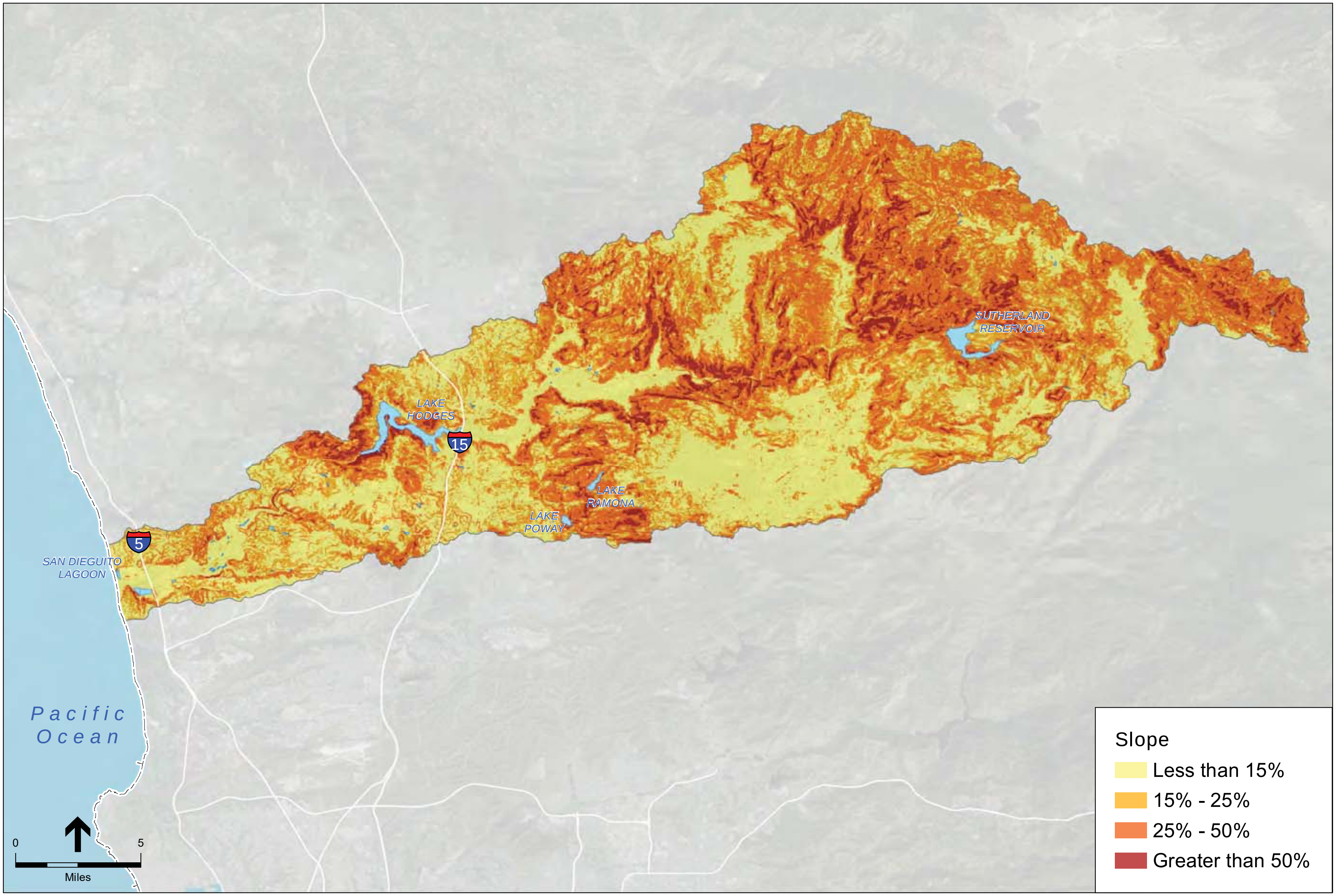


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-61**

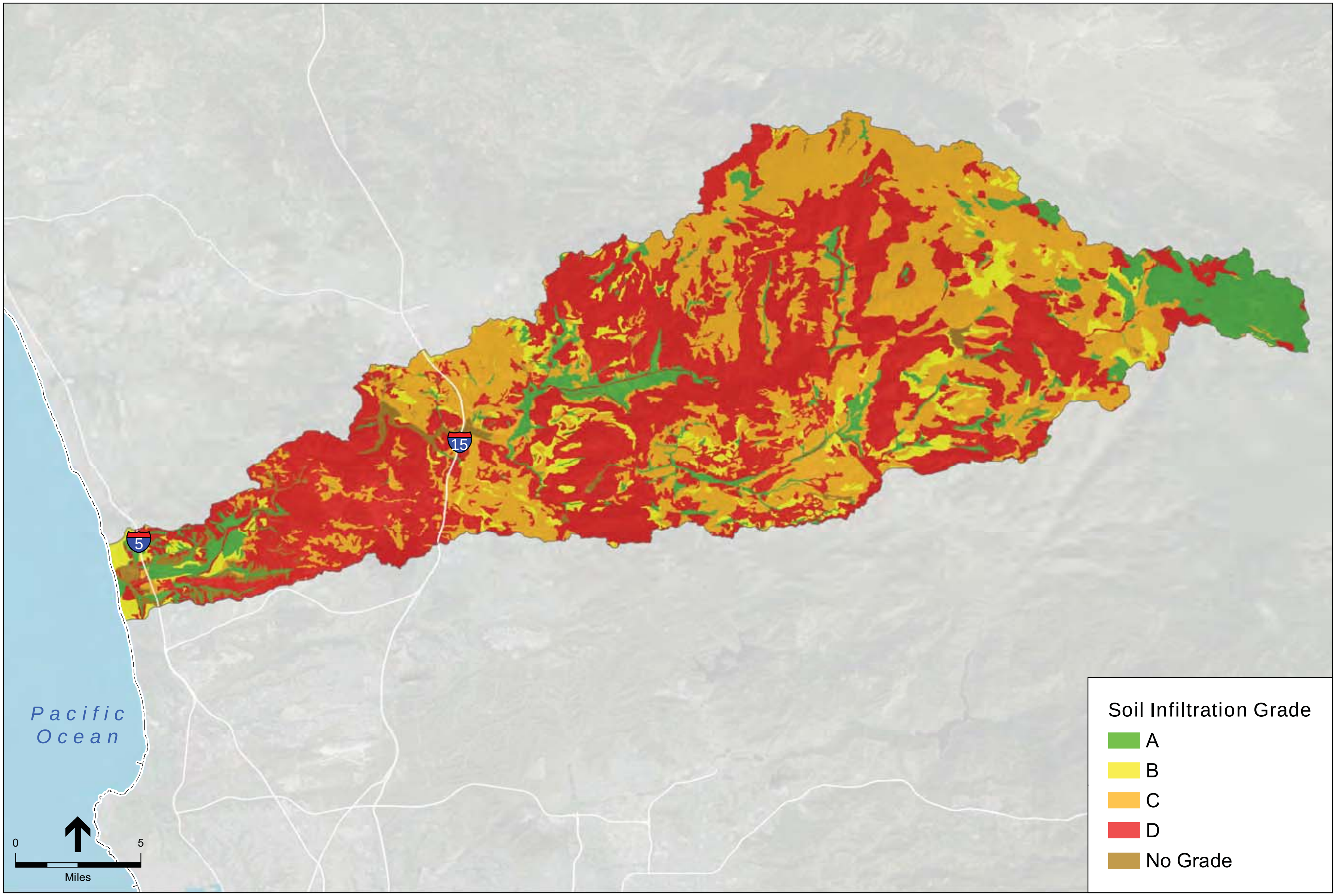
Planned Land Use within the San Dieguito Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

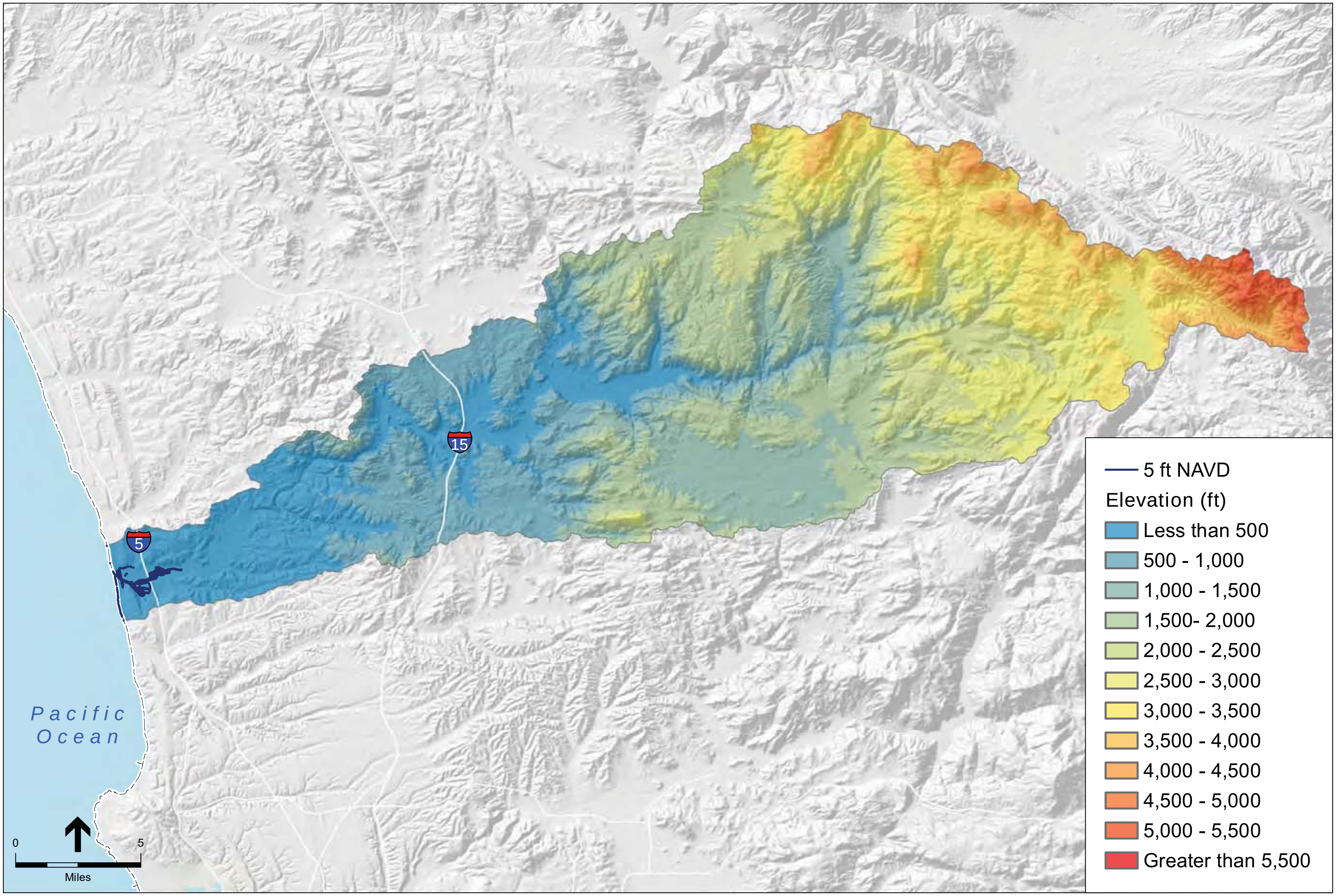
Figure **B-62**
Slope within the San Dieguito Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016; USDA

SCFS . 140075.20

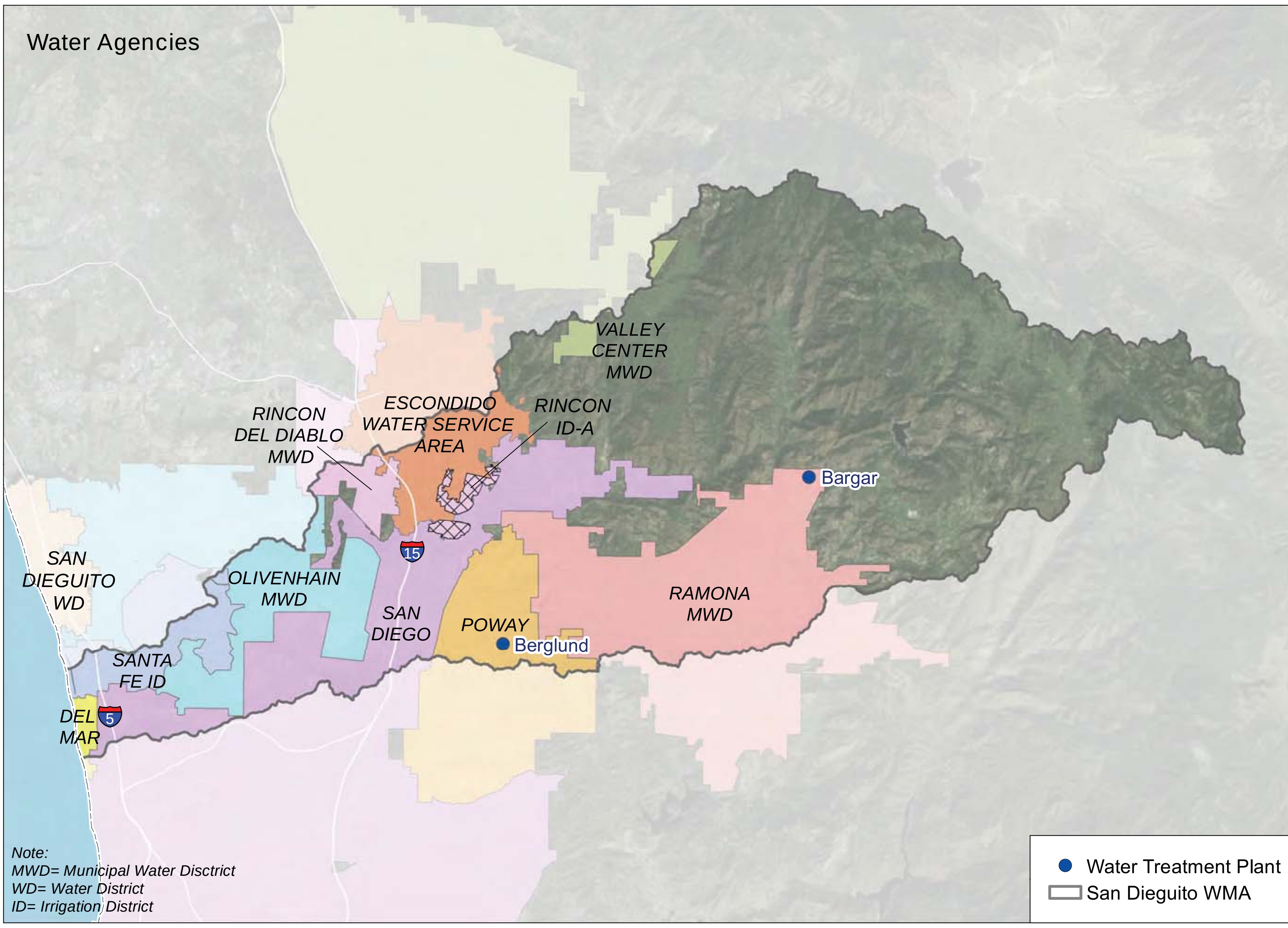
Figure **B-63**
Soils within the San Dieguito Water Management Area

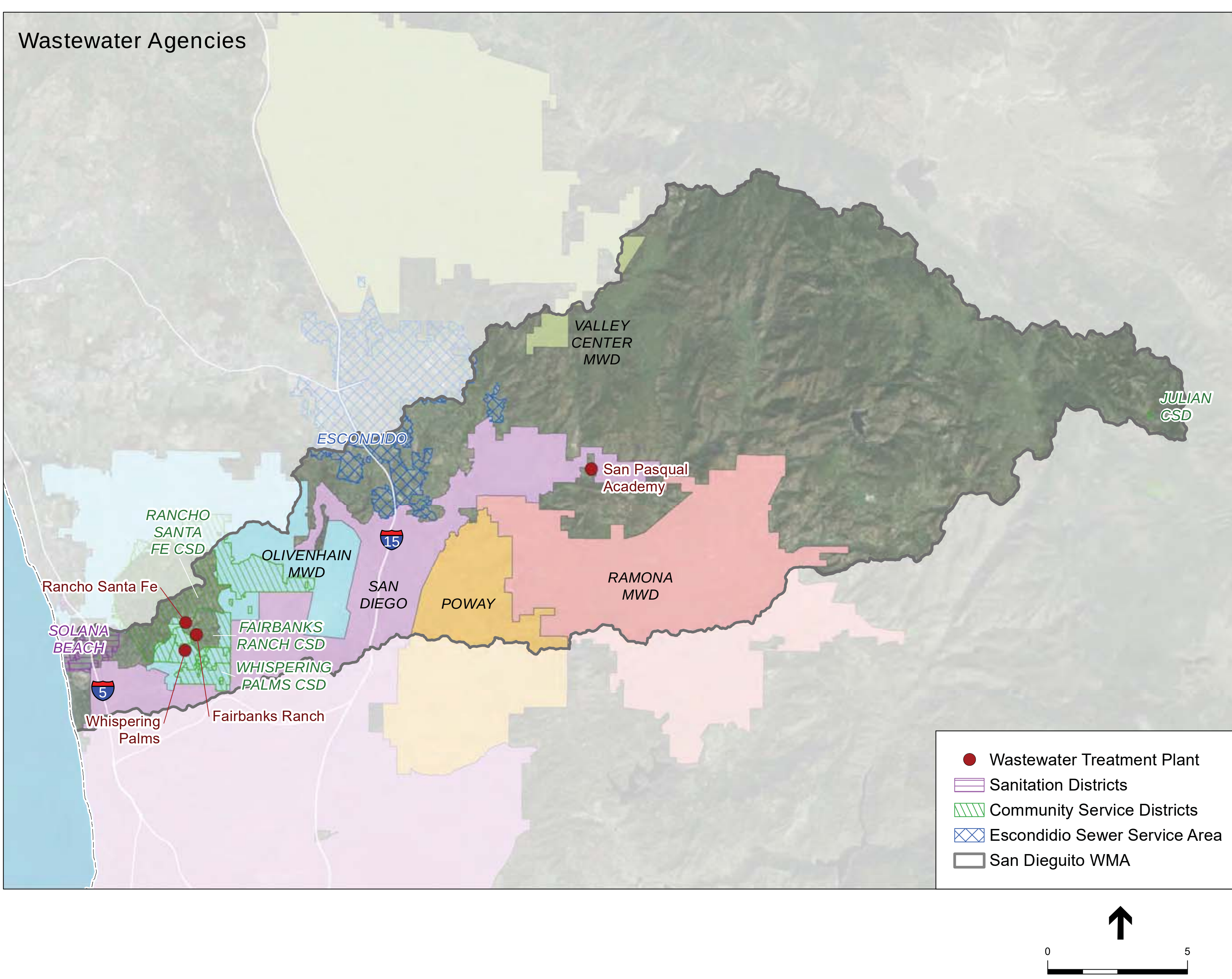


SOURCE: ESRI, 2016; SanGIS, 2016; USGS

SCFS . 140075.20

Figure **B-64**
Topography within the San Dieguito Water Management Area

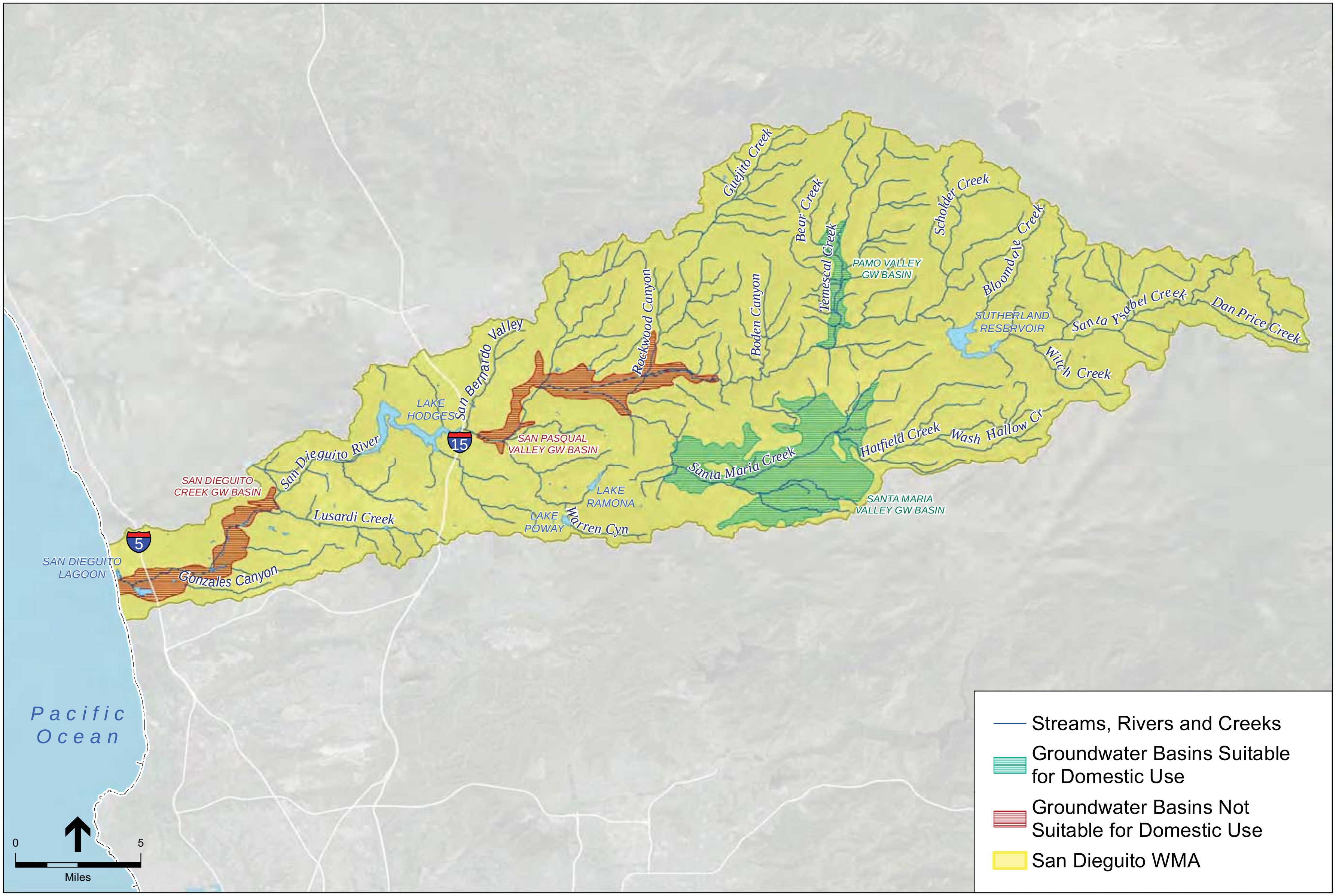




SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-65**
Water Agencies and Wastewater Agencies
within the San Dieguito Water Management Area

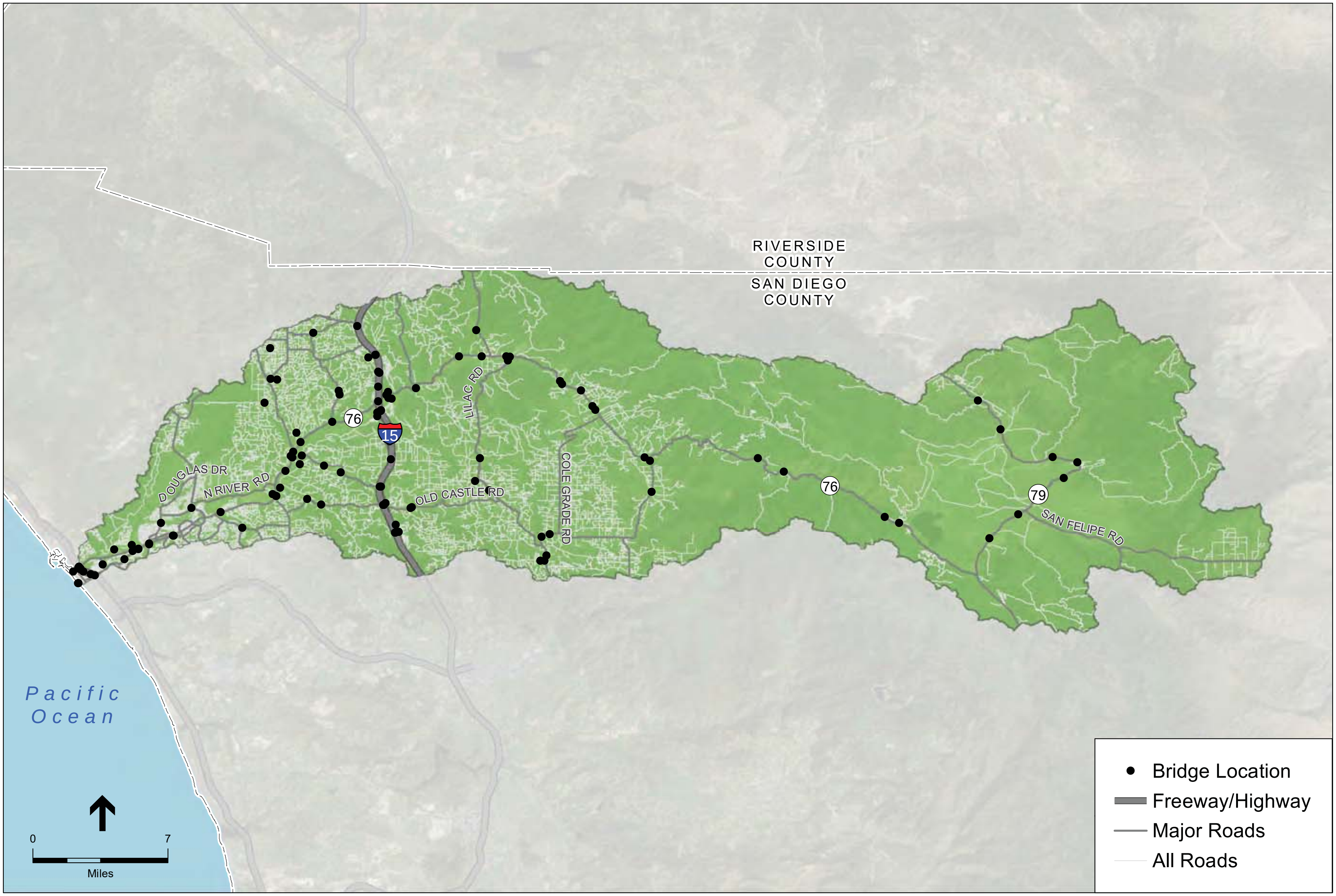


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-66**

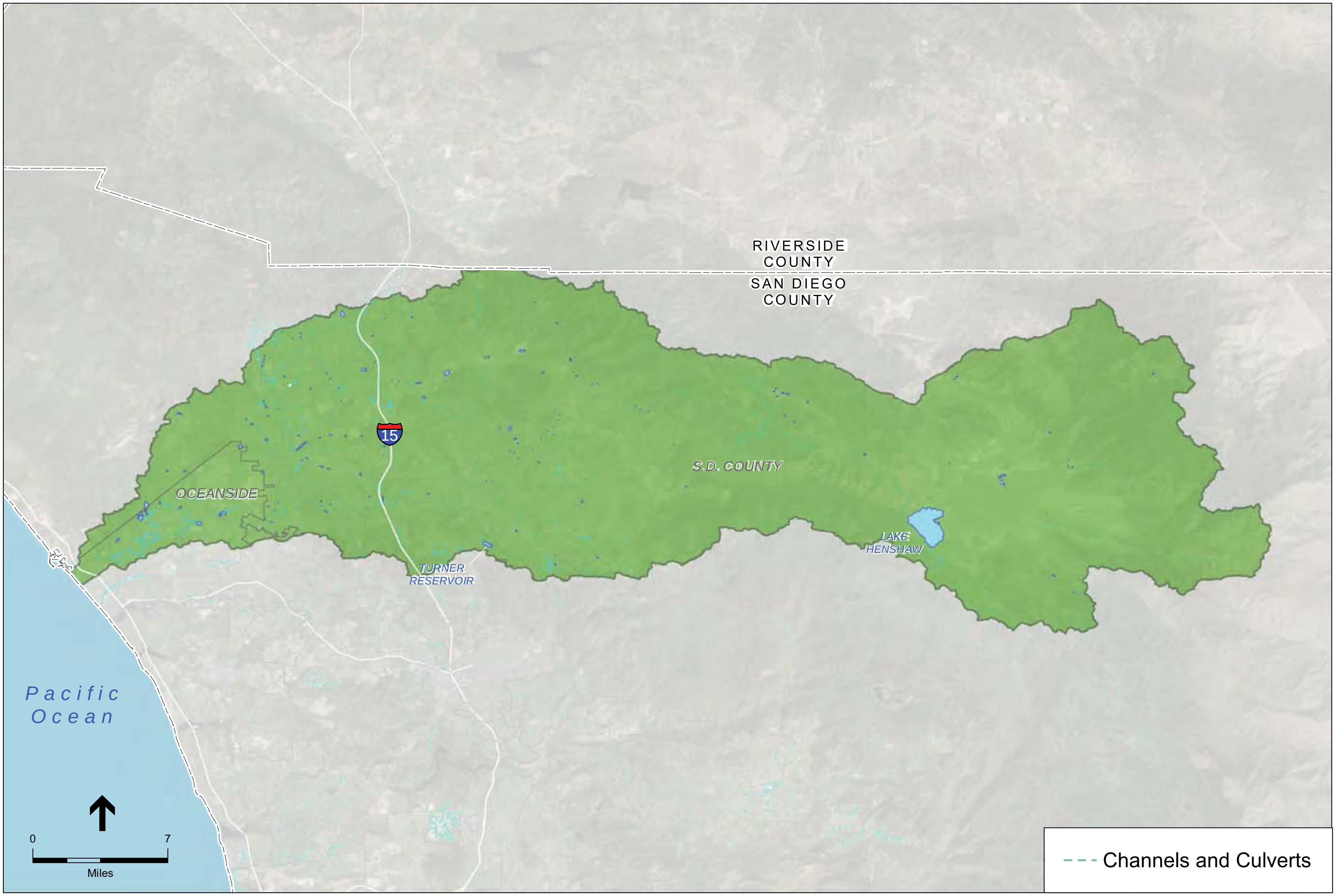
Water Features within the San Dieguito Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-67**
Built Environments within the San Luis Rey Water Management Area

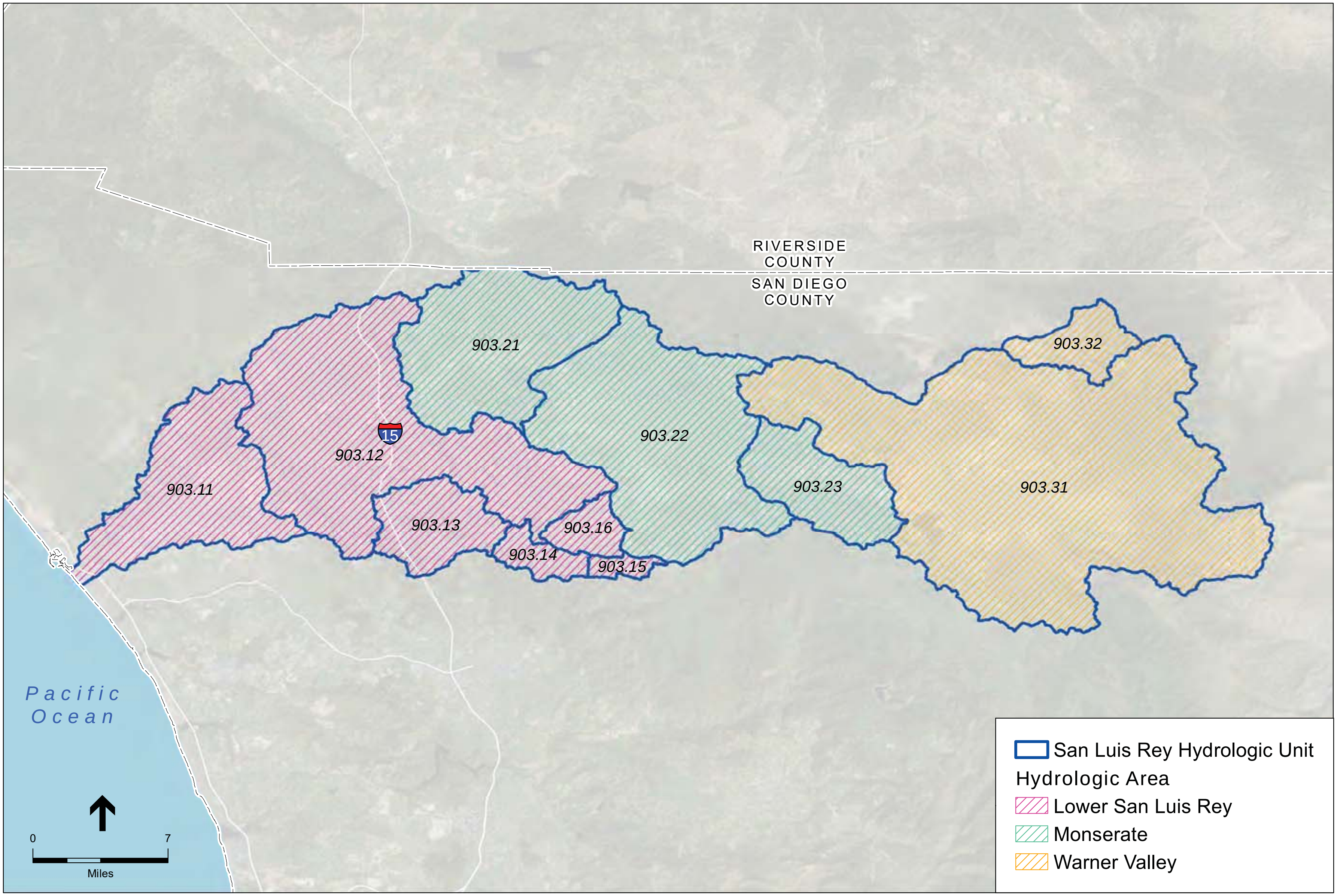


SOURCE: ESRI, 2016; SanGIS, 2016; City of Oceanside, 2016

SCFS . 140075.20

Figure **B-68**

Flood Control System within the San Luis Rey Water Management Area

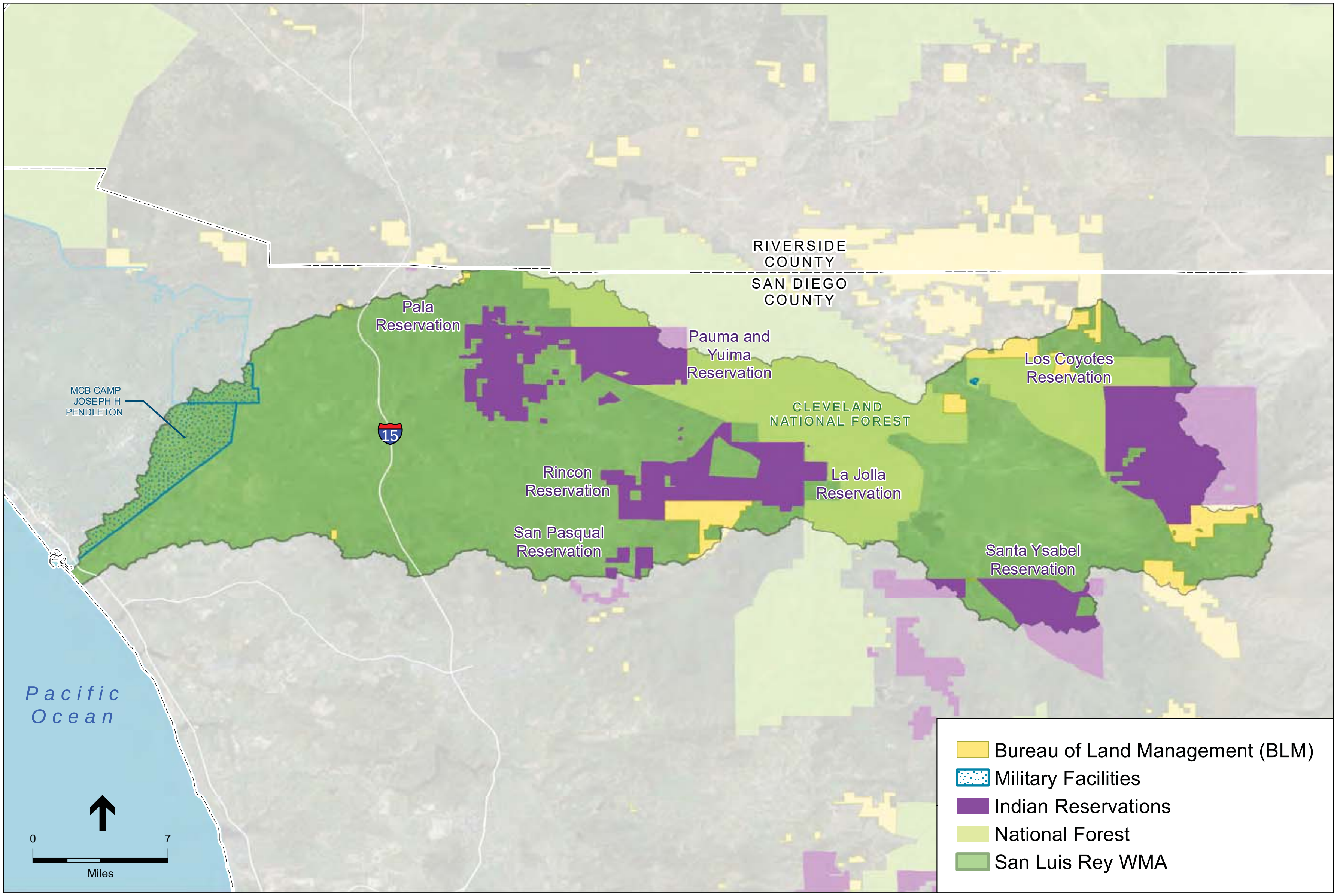


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-69**

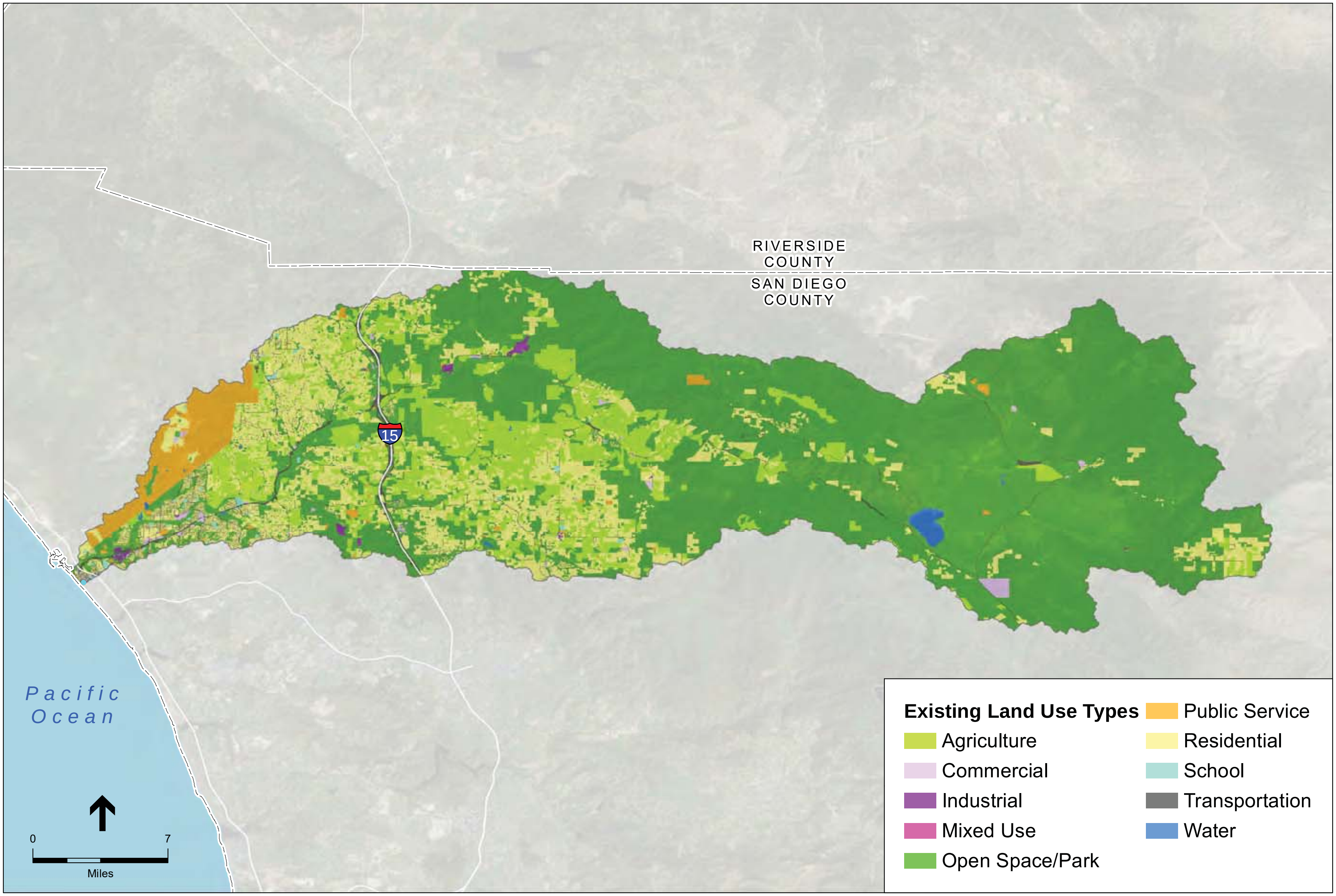
Hydrologic Units and Areas within the San Luis Rey Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-70**
Land Use Agencies within the San Luis Rey Water Management Area

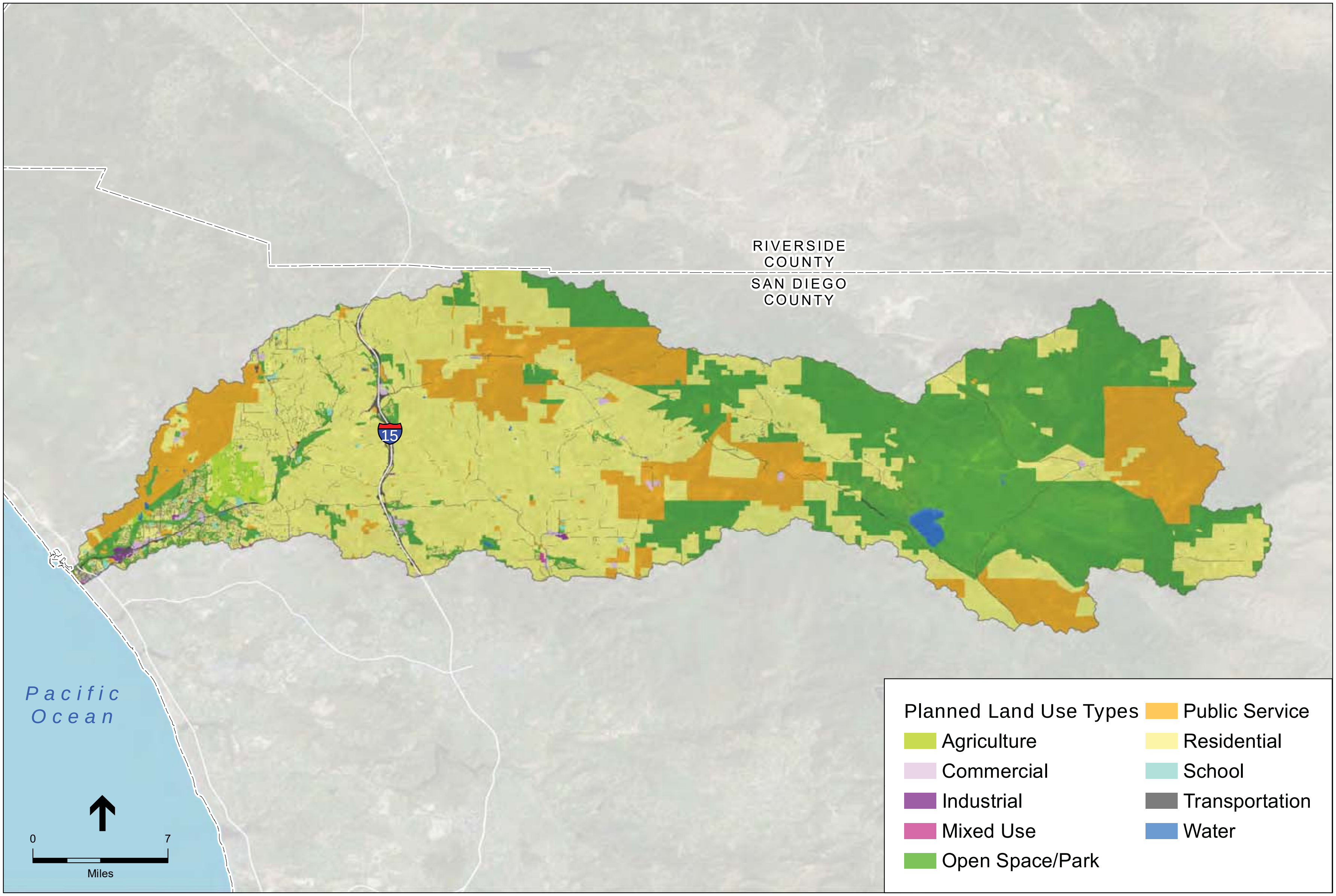


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-71

Existing Land Use within the San Luis Rey Water Management Area

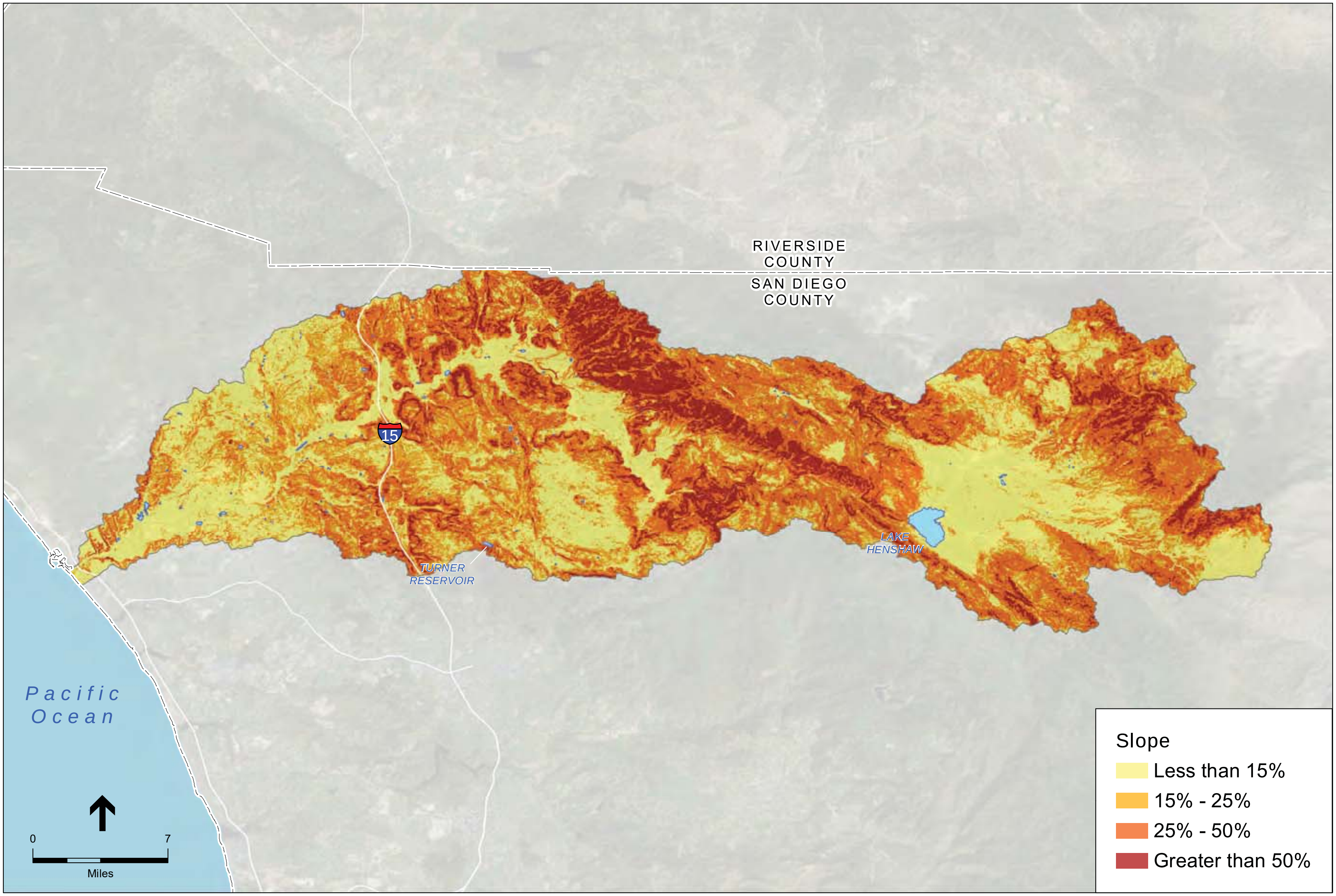


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-72**

Planned Land Use within the San Luis Rey Water Management Area

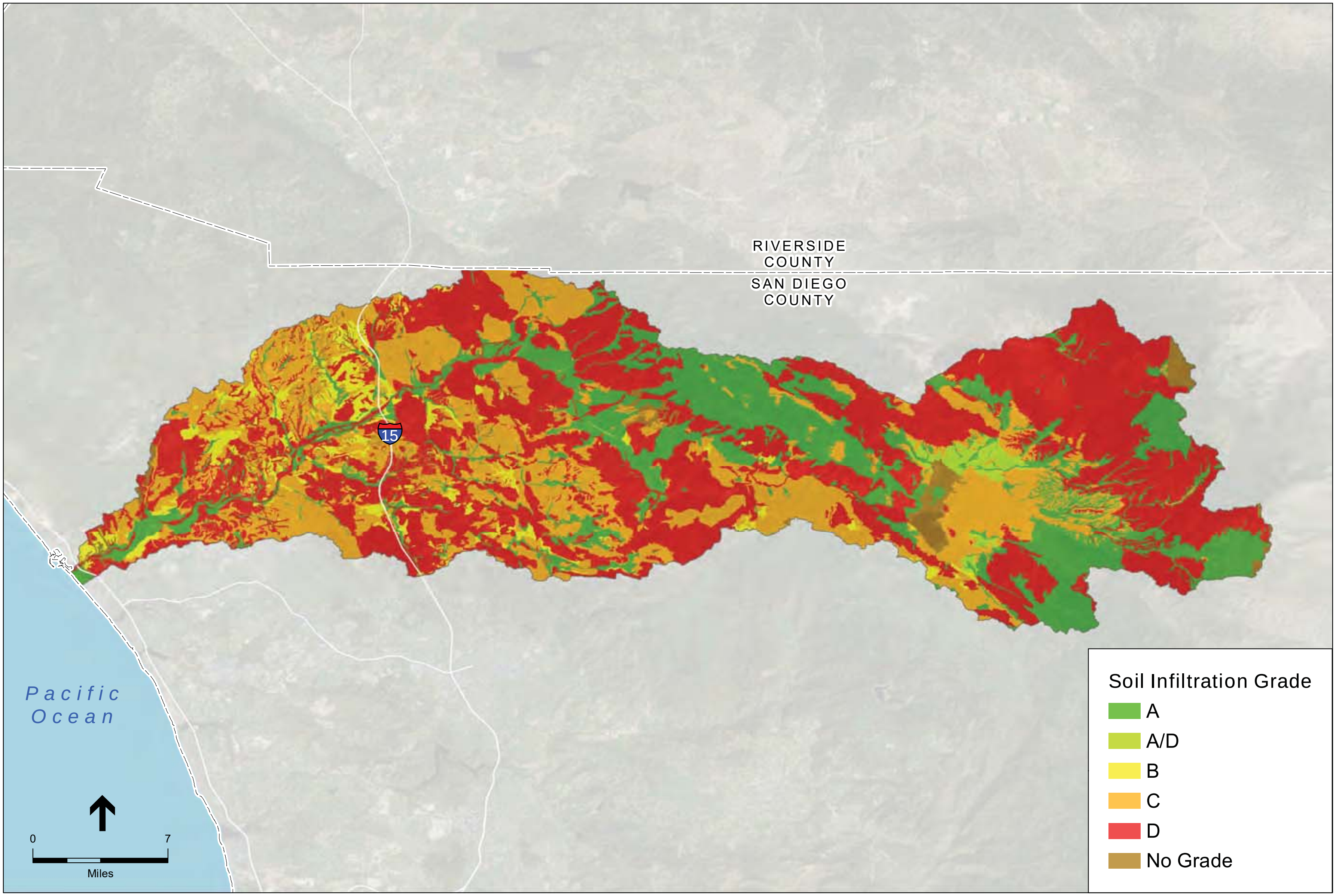


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-73**

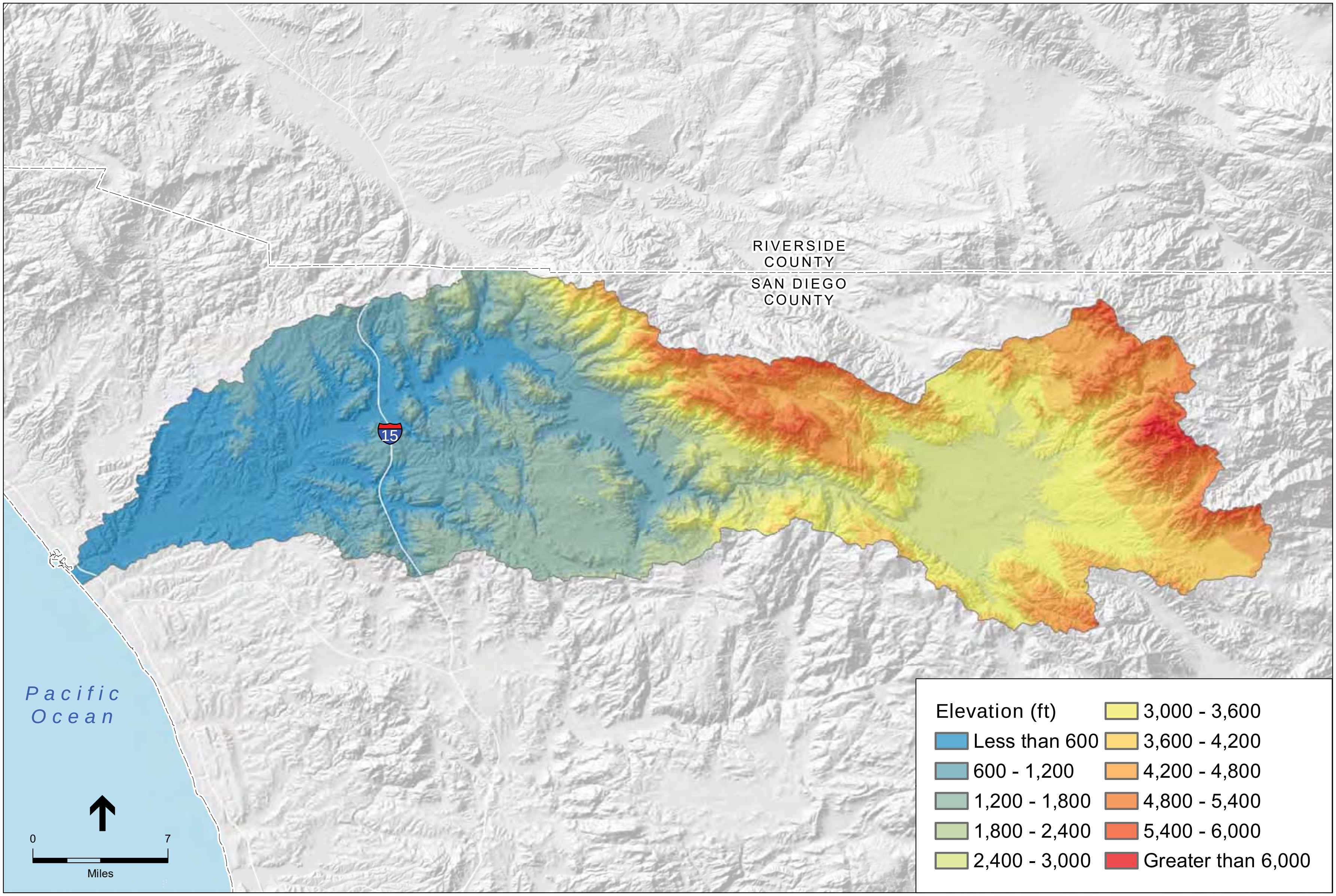
Slope within the San Luis Rey Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

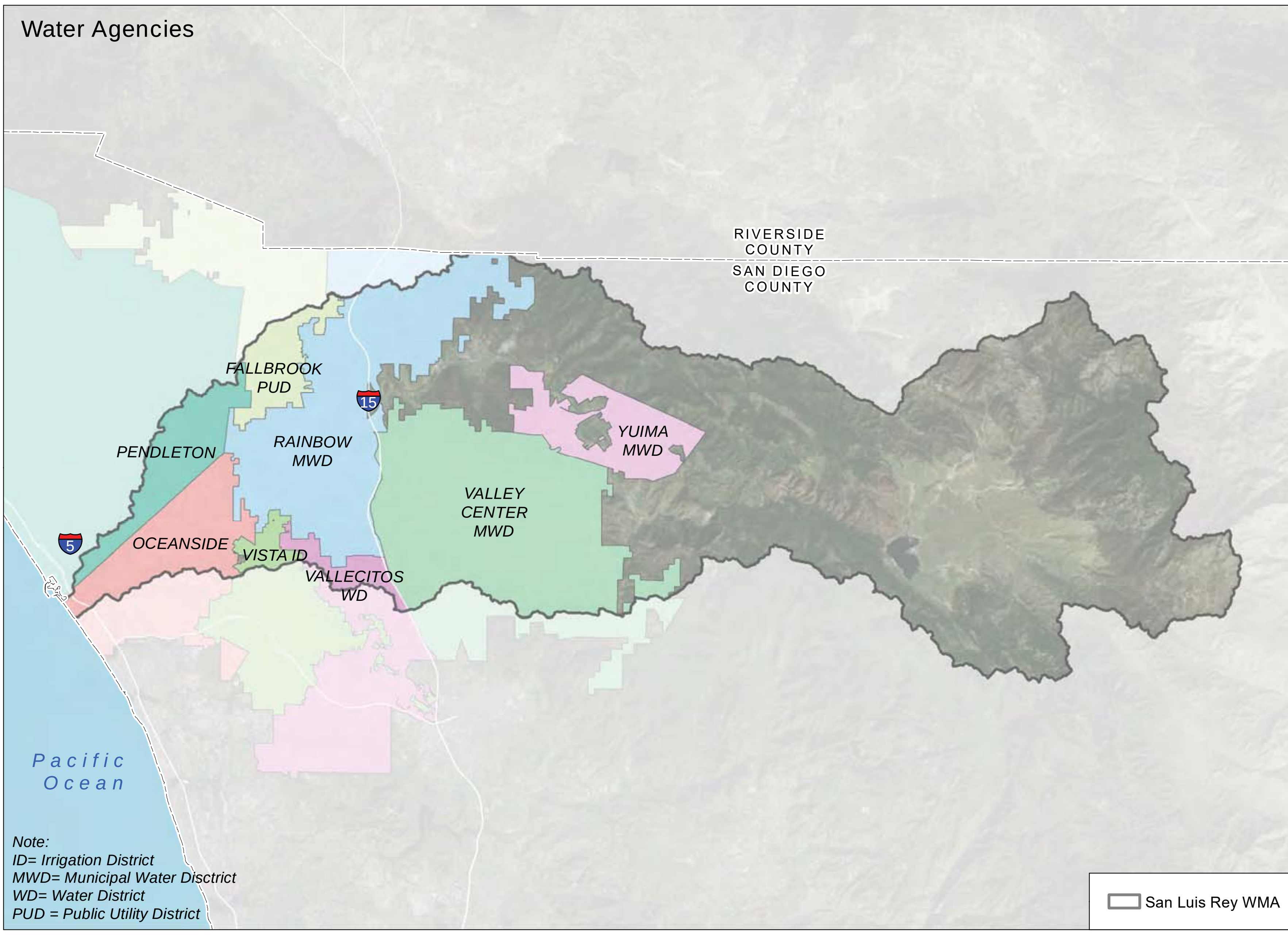
Figure **B-74**
Soils within the San Luis Rey Water Management Area

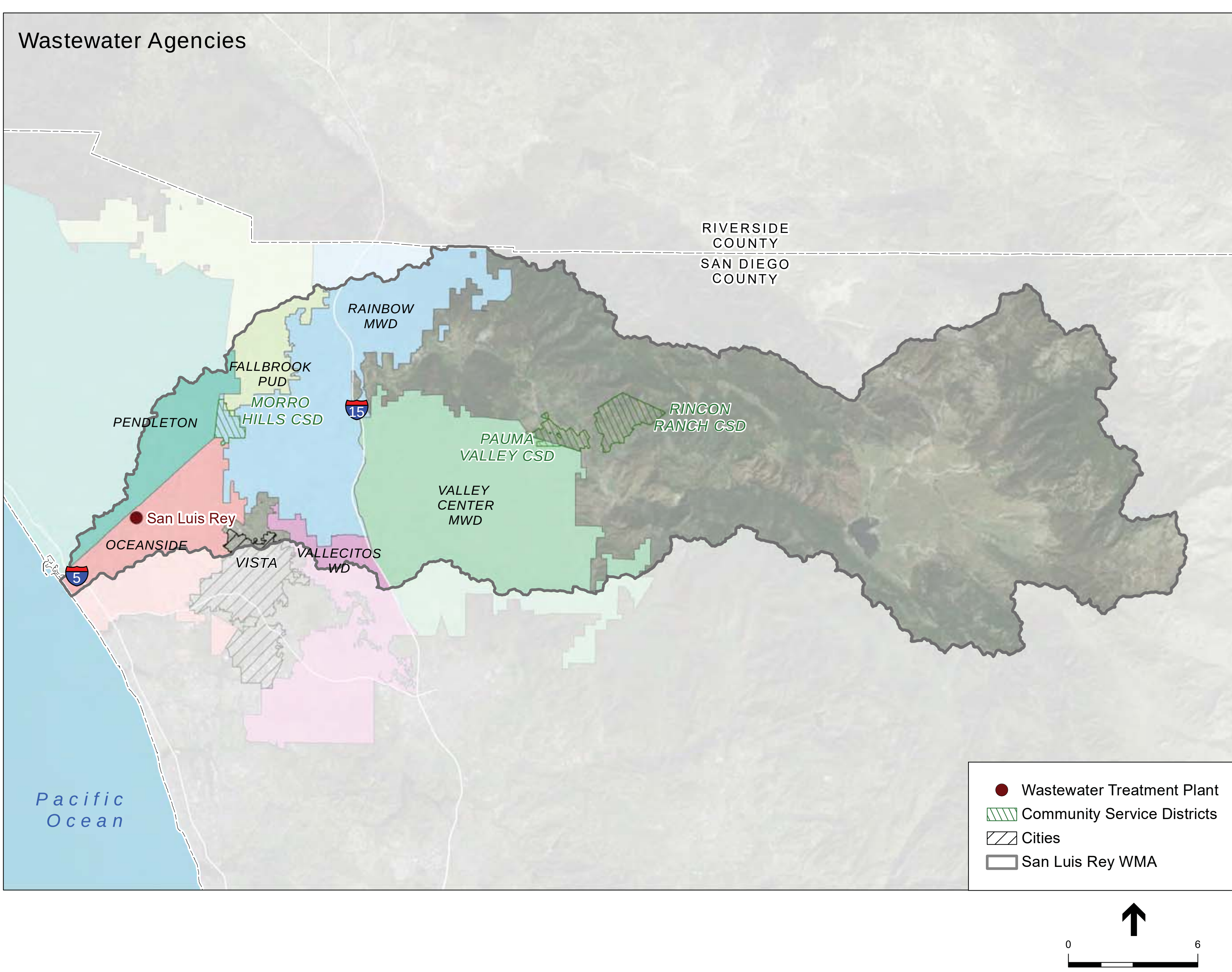


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-75**
Topography within the San Luis Rey Water Management Area

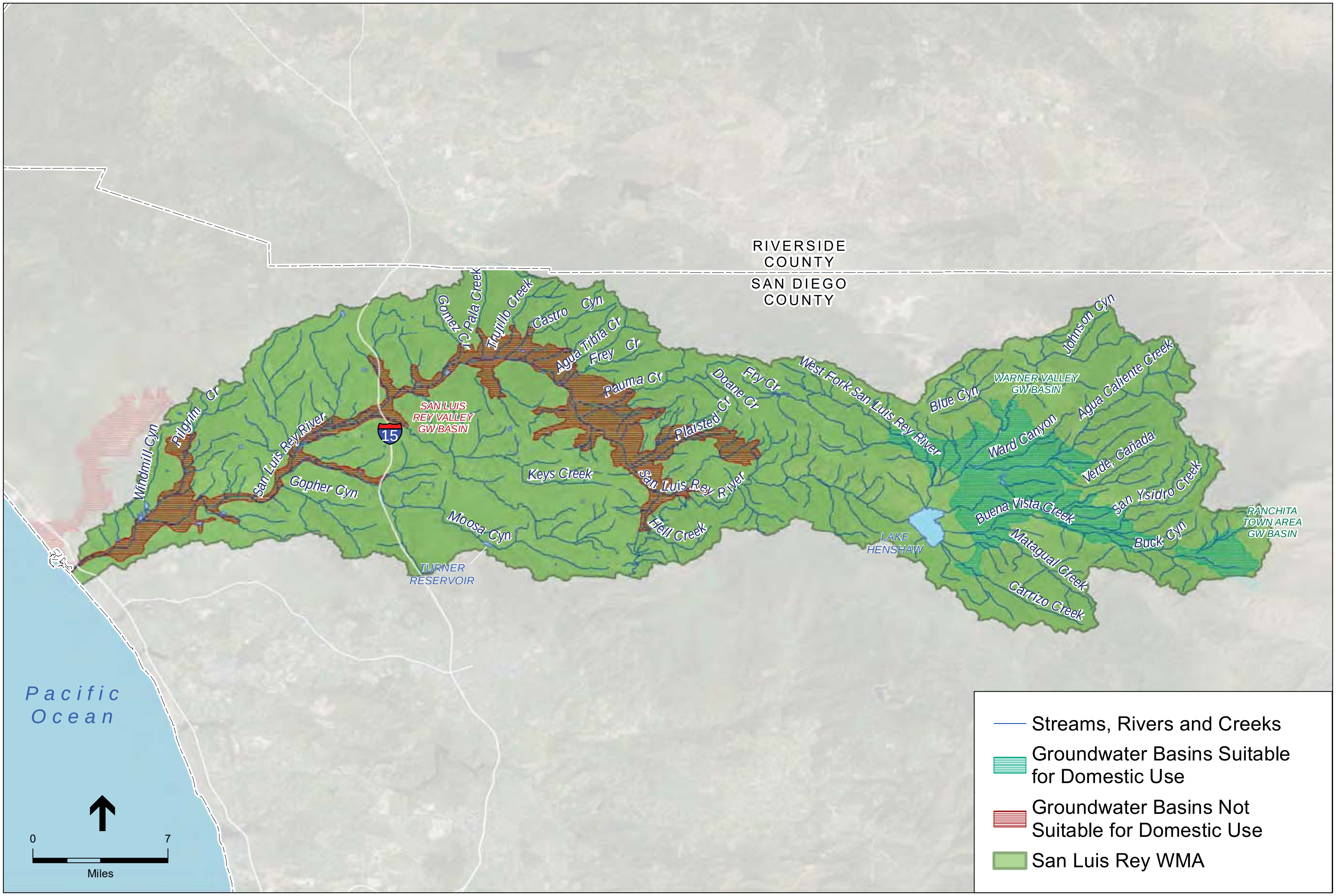




SOURCE: ESRI, 2016; SanGIS, 2016; IRWM, 2016

SCFS . 140075.20

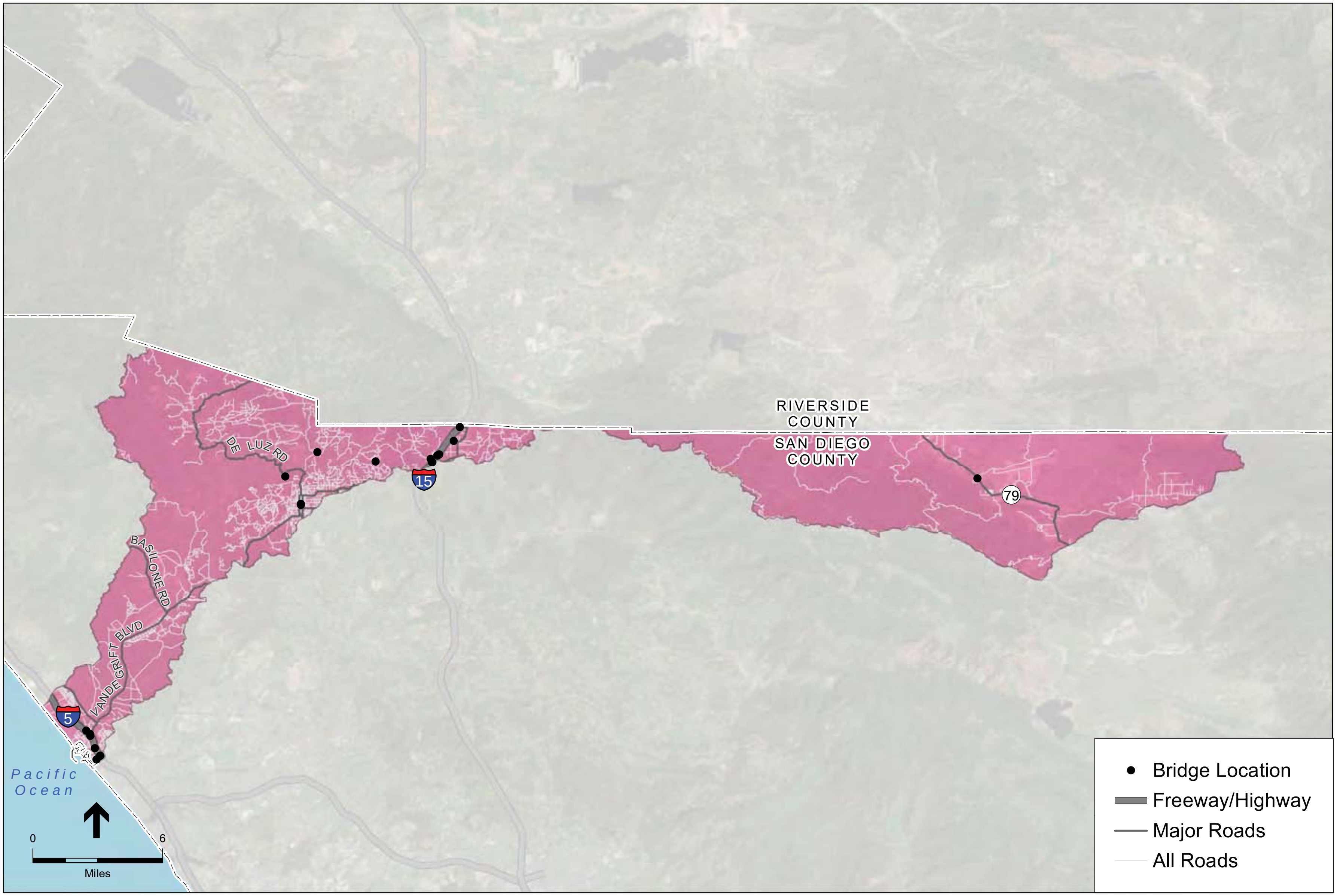
Figure **B-76**
Water Agencies and Wastewater Agencies within the San Luis Rey Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-77**
Water Features within the San Luis Rey Water Management Area

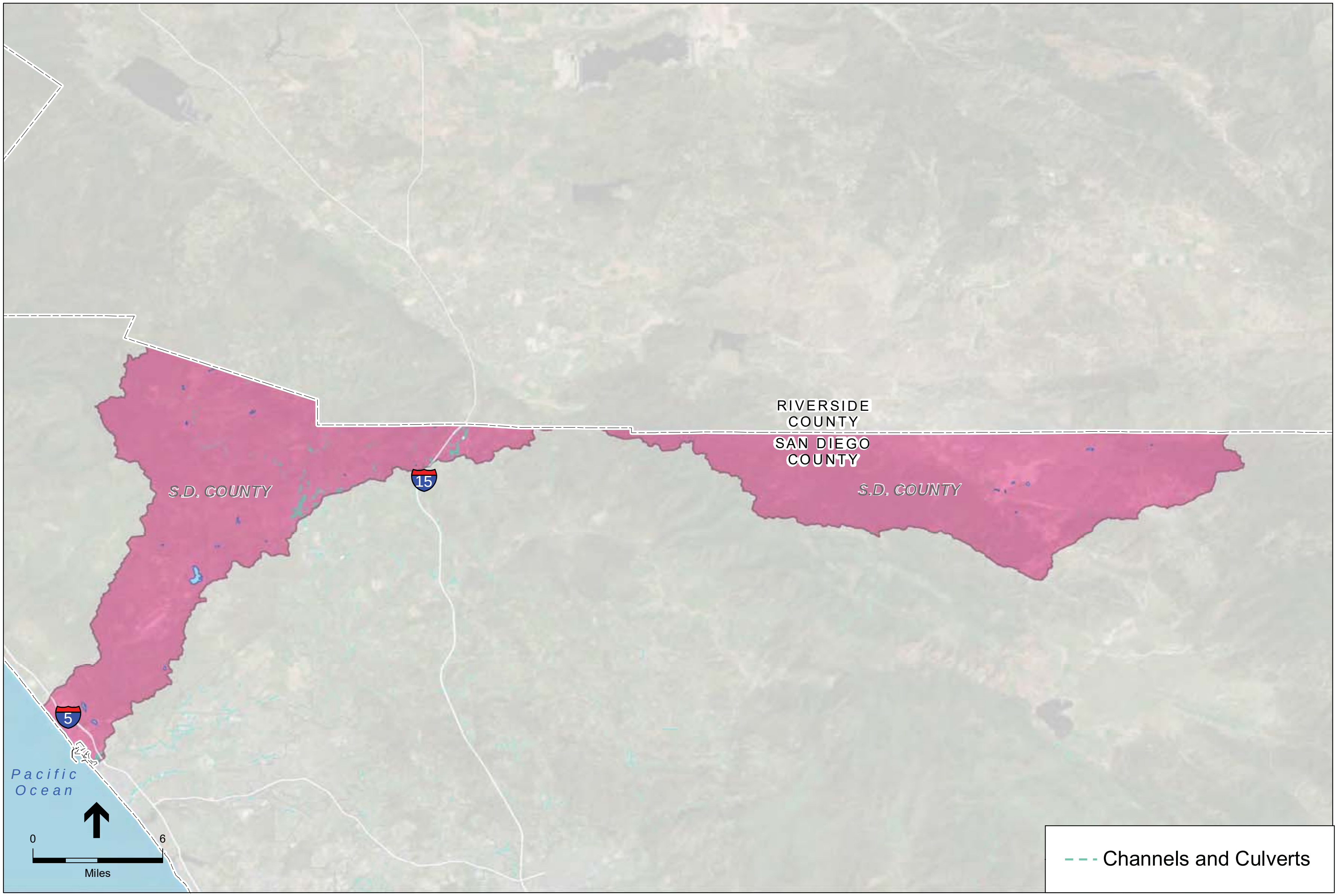


SOURCE: ESRI, 2016; SanGIS, 2016; Caltrans

SCFS . 140075.20

Figure **B-78**

Built Environments within the Santa Margarita Water Management Area

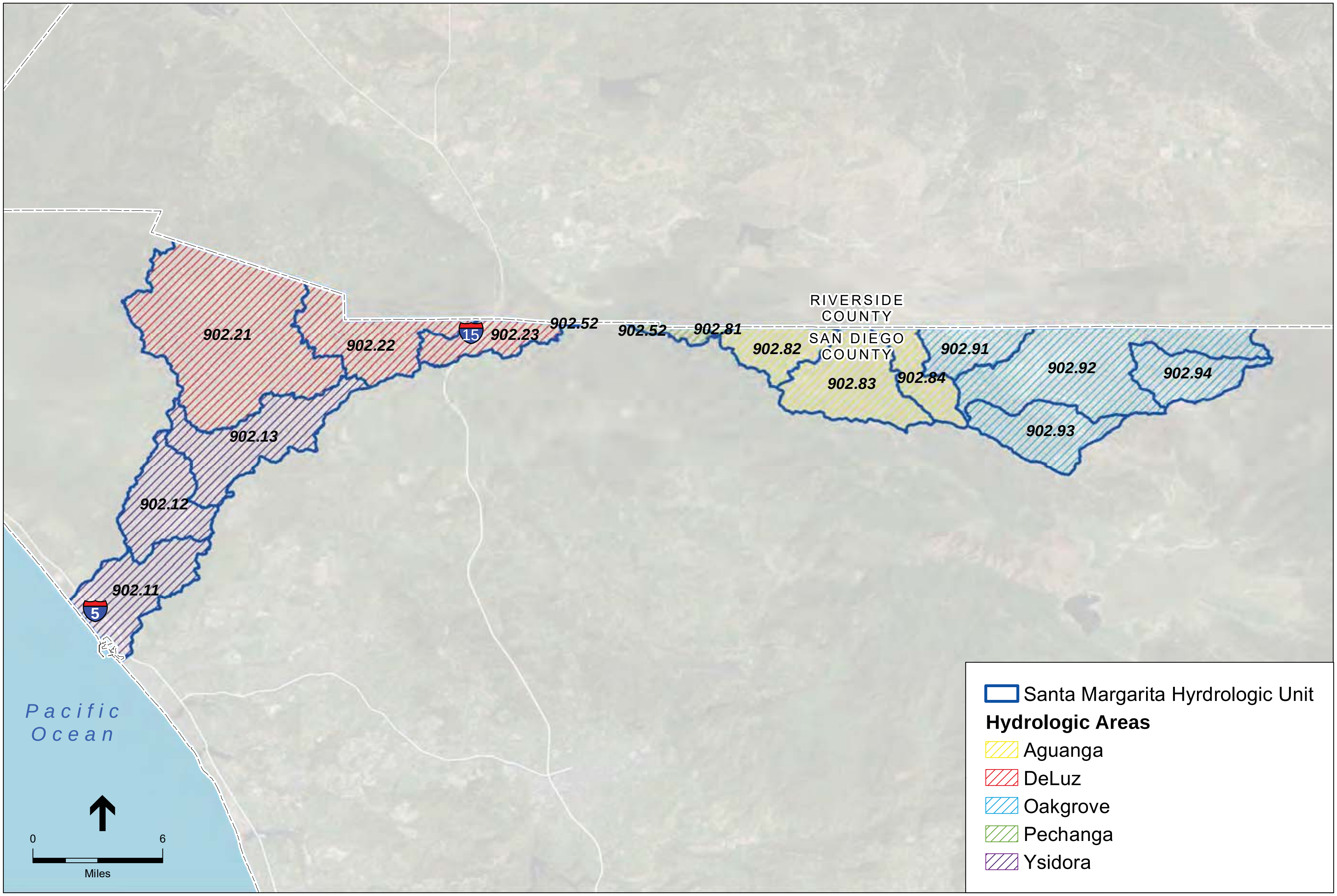


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-79**

Flood Control System within the Santa Margarita Water Management Area

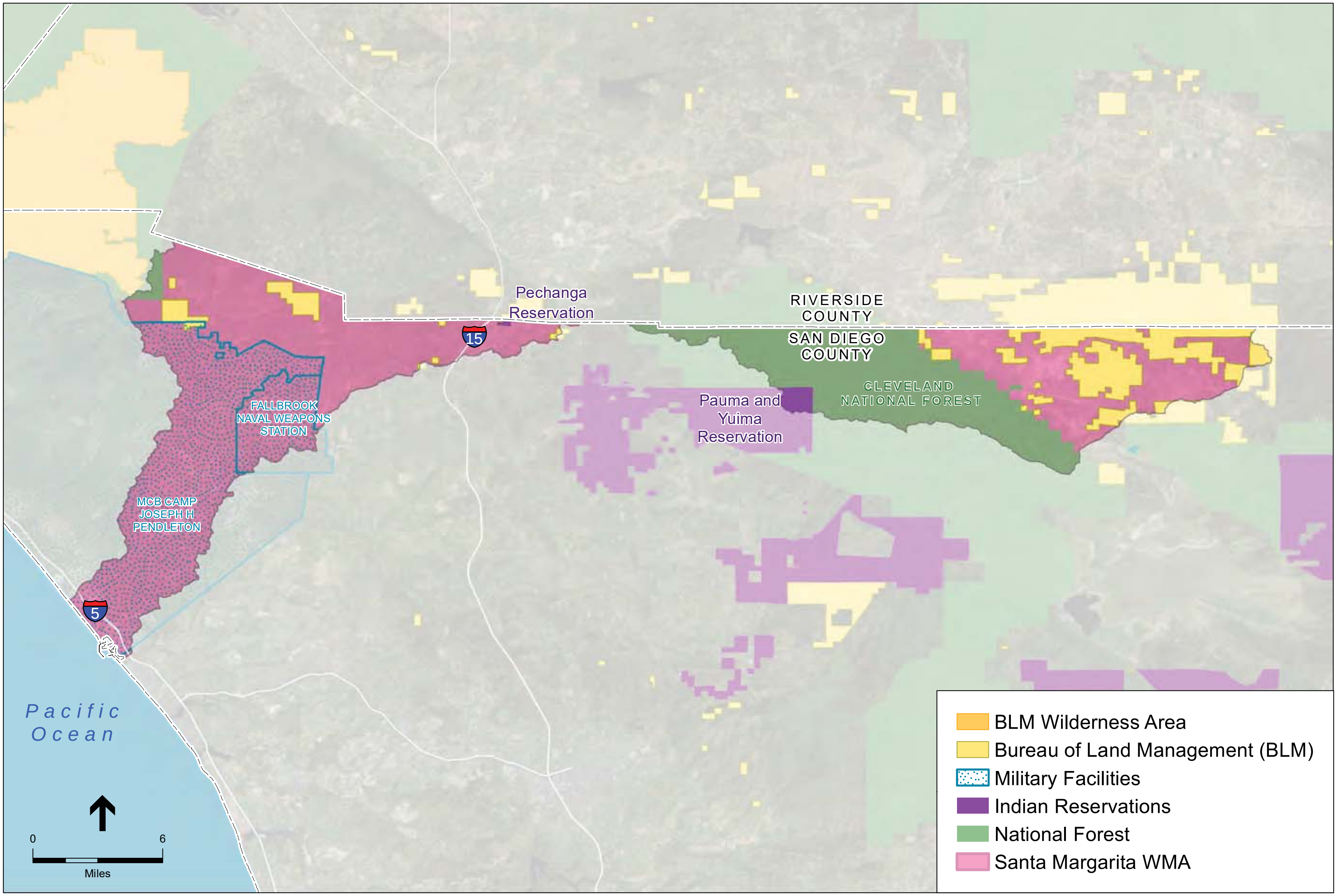


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-80

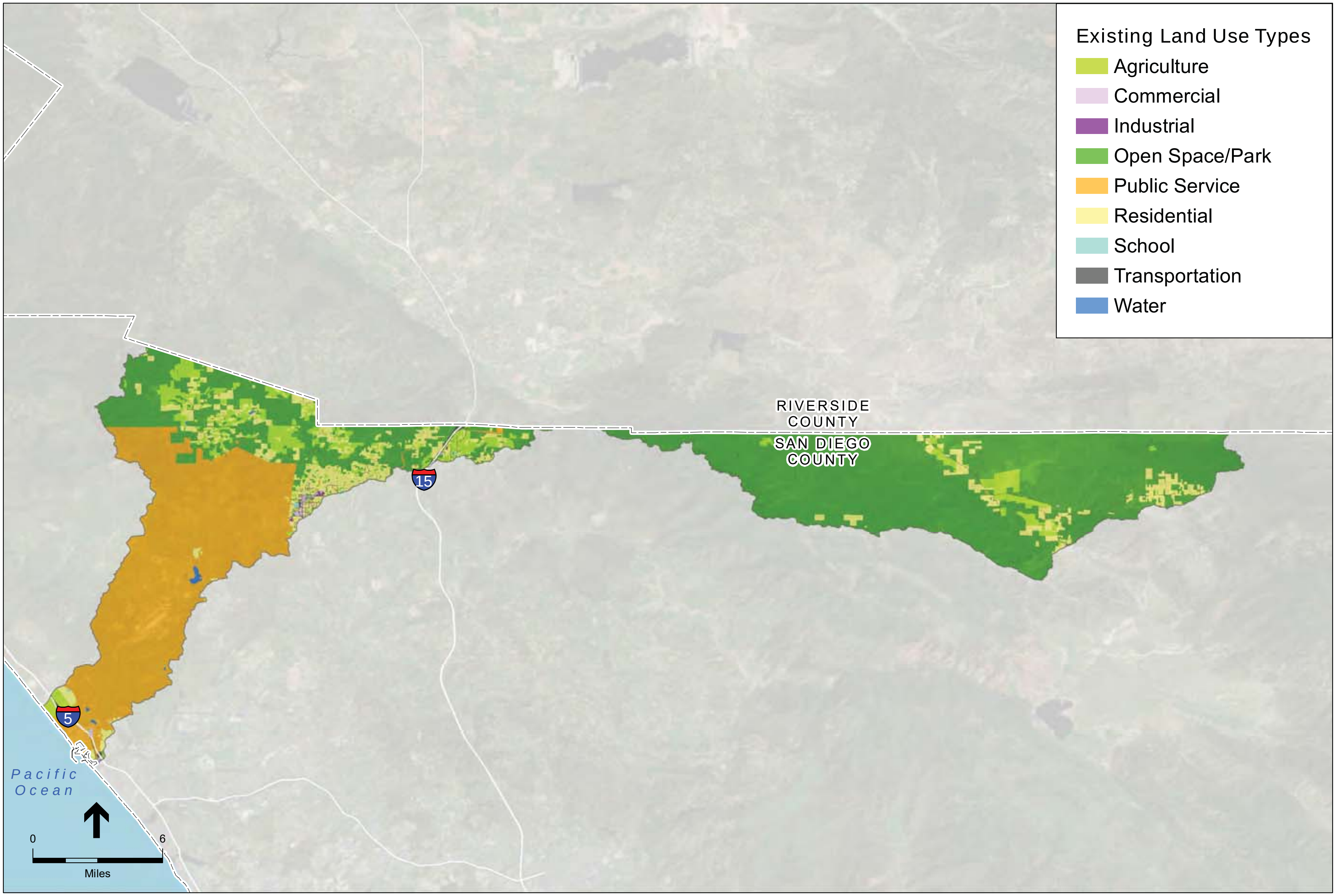
Hydrologic Units and Areas within the Santa Margarita Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016; Bureau of Land Management

SCFS . 140075.20

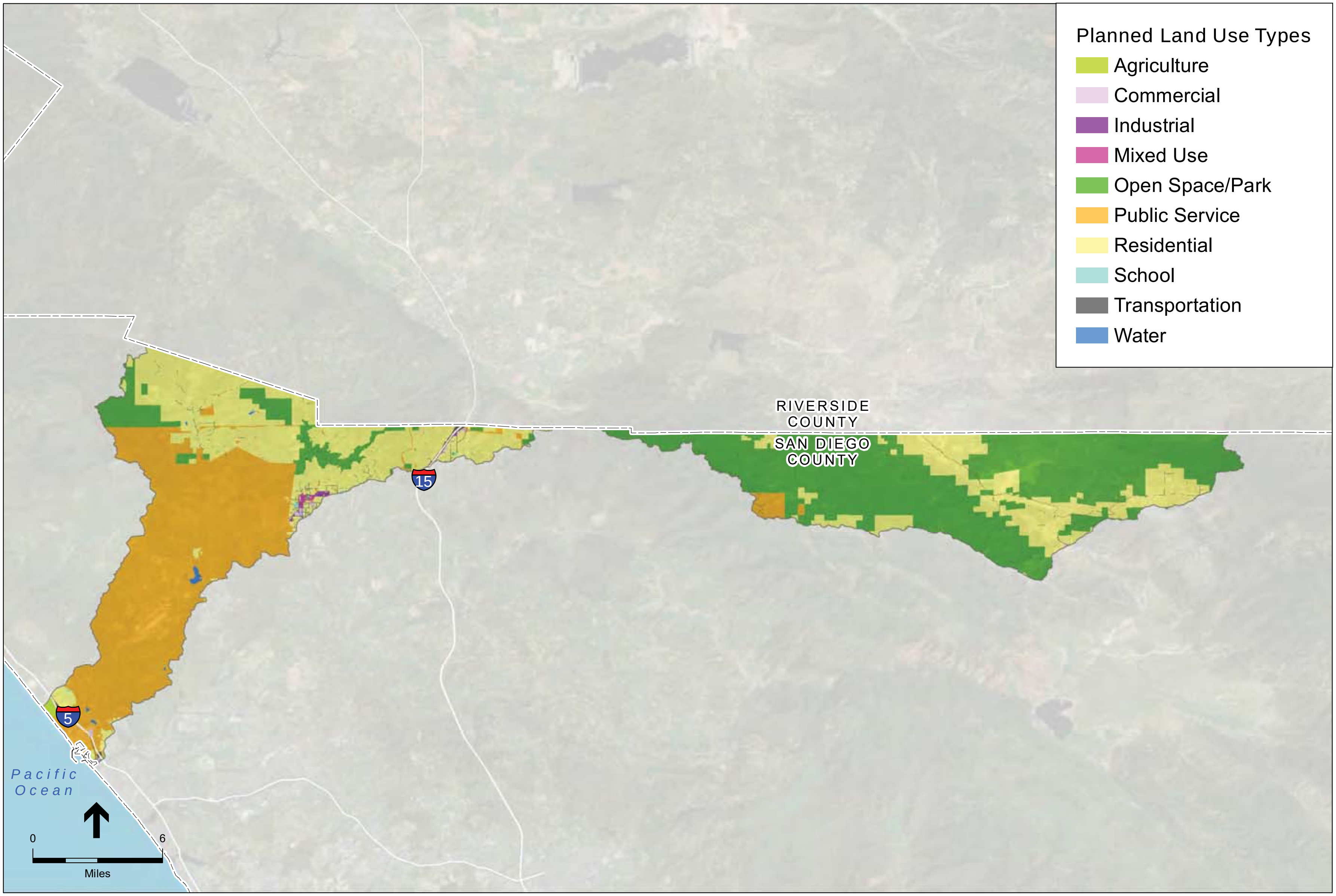
Figure **B-81**
Land Use Agencies within the Santa Margarita Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

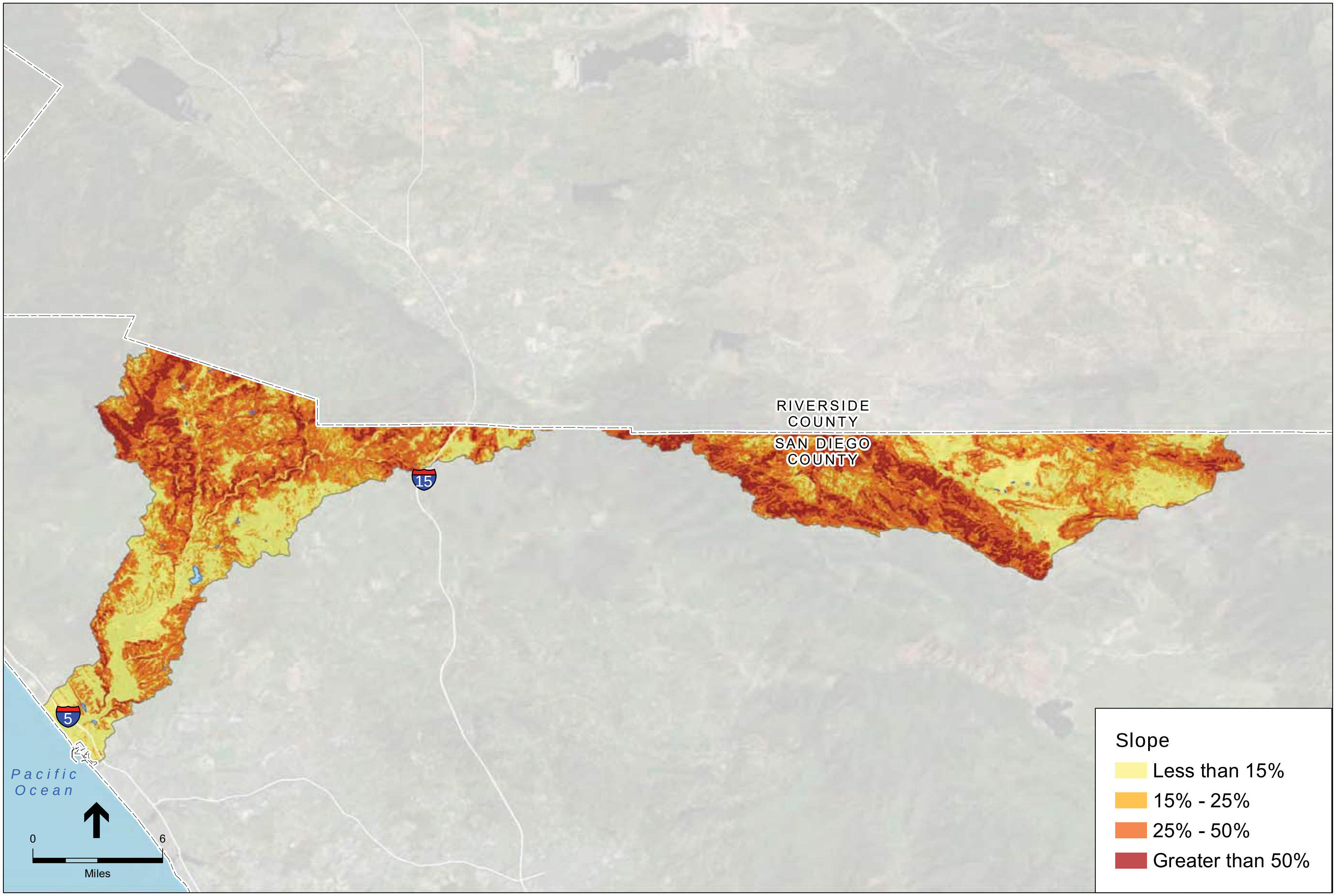
Figure **B-82**
Existing Land Use within the Santa Margarita Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-83**
Planned Land Use within the Santa Margarita Water Management Area

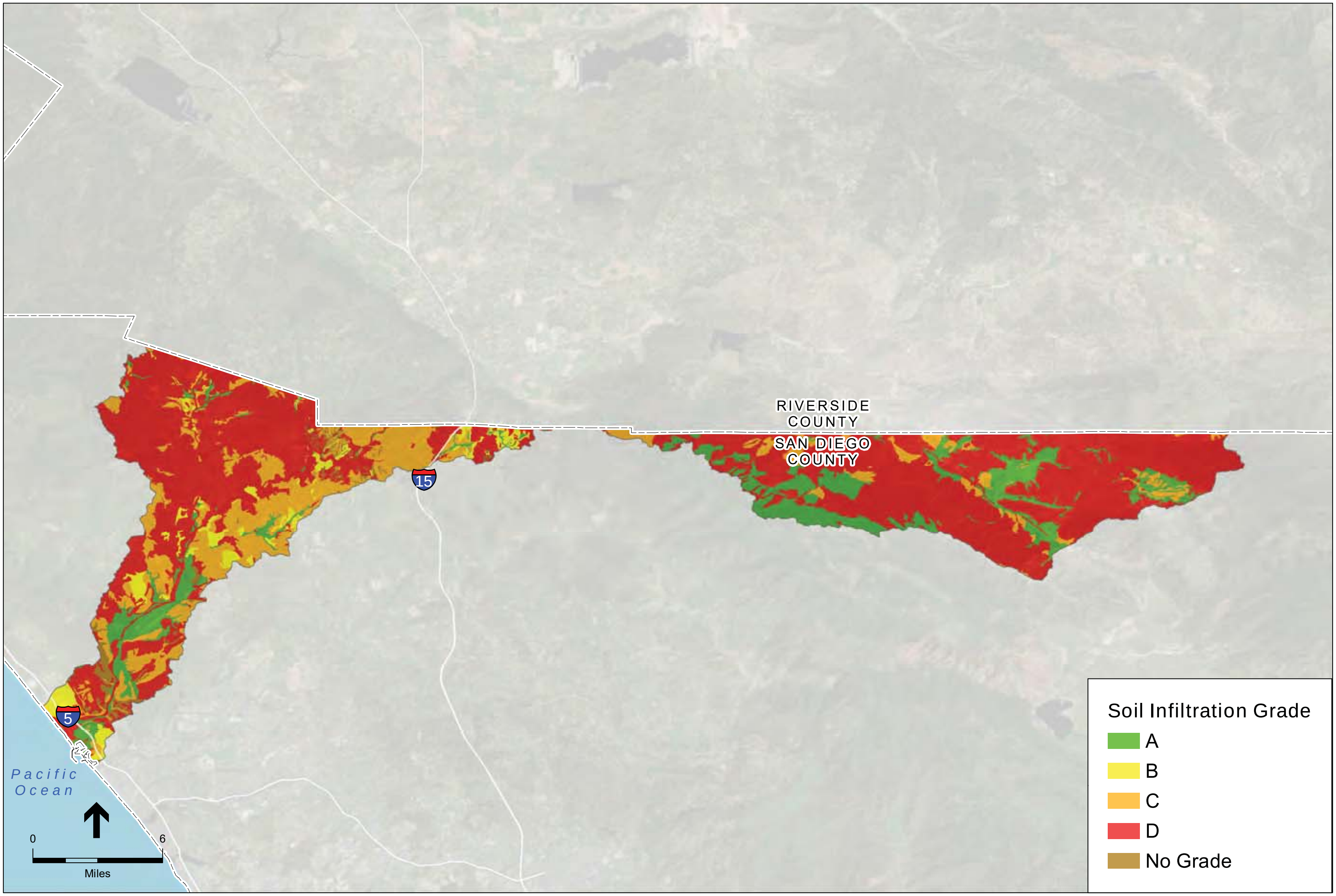


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-84**

Slope within the Santa Margarita Water Management Area

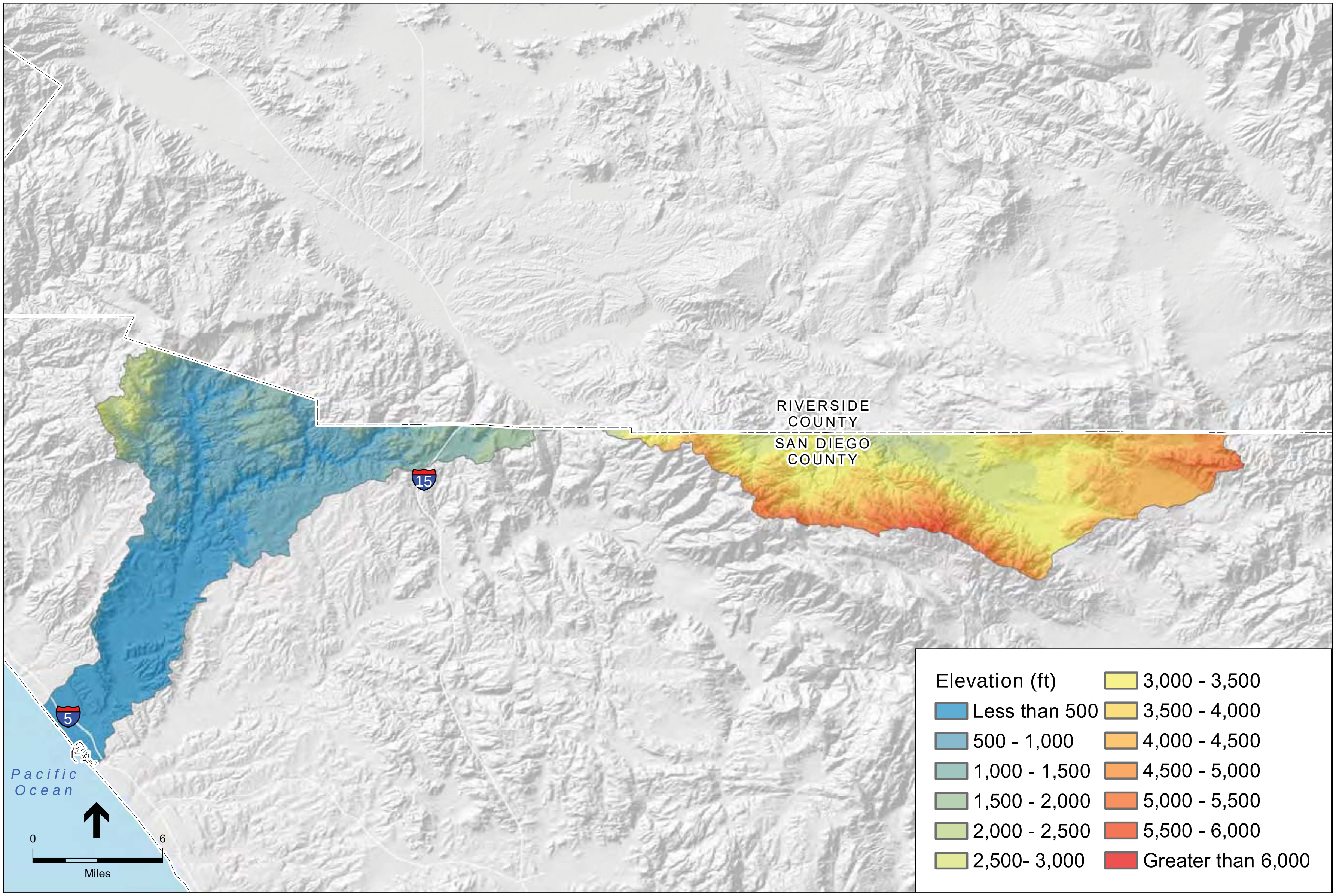


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-85**

Soils within the Santa Margarita Water Management Area

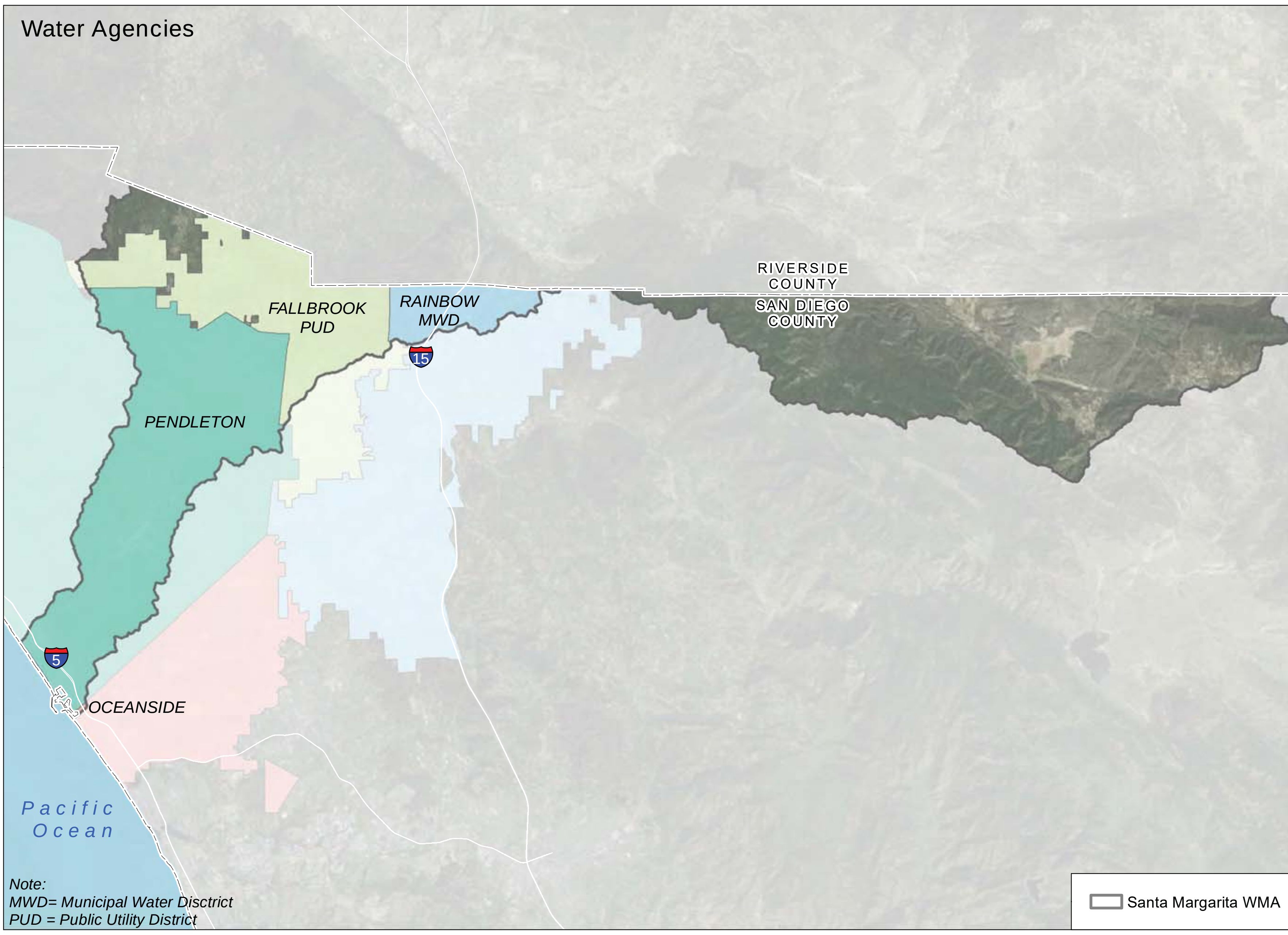


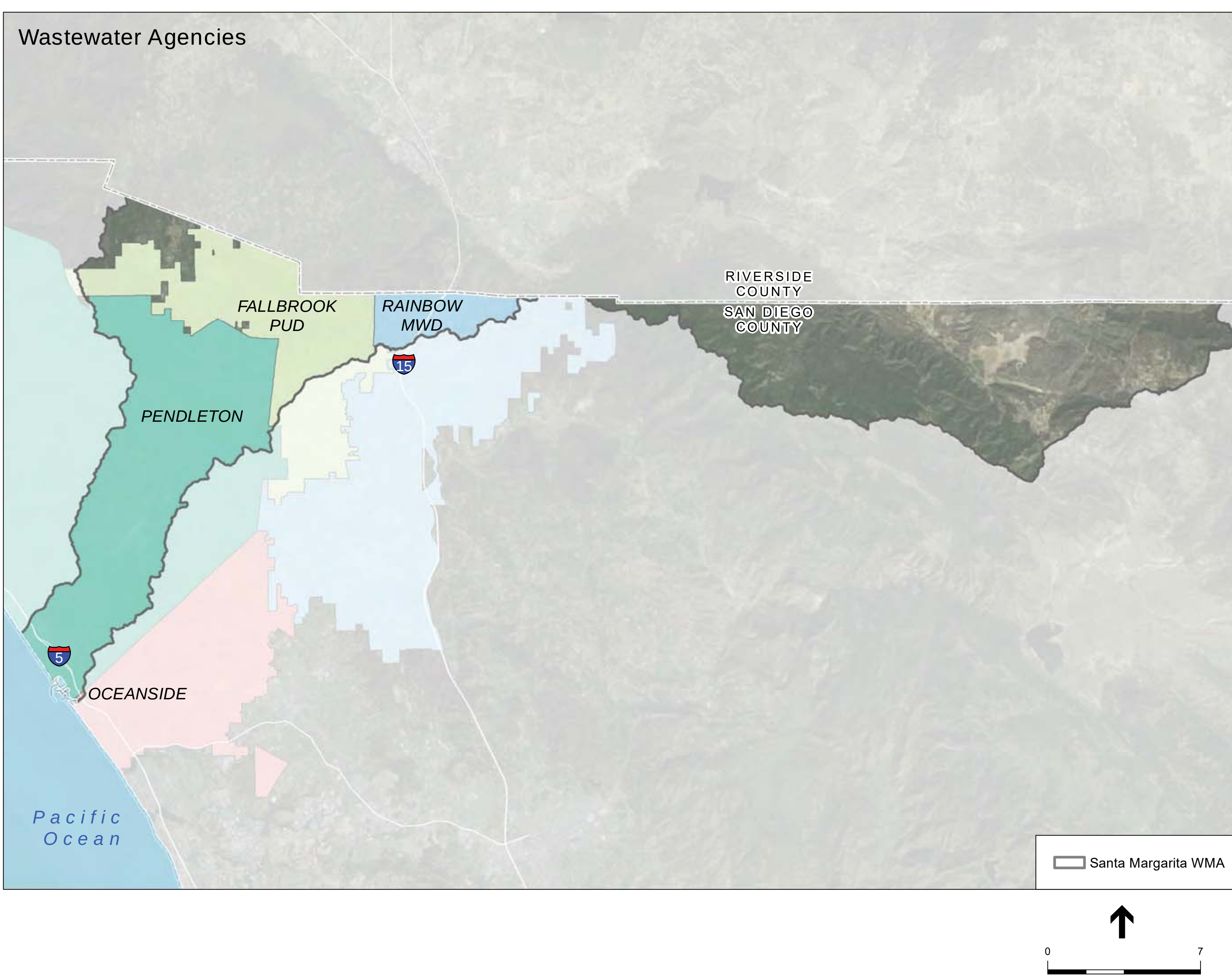
SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-86**

Topography within the Santa Margarita Water Management Area

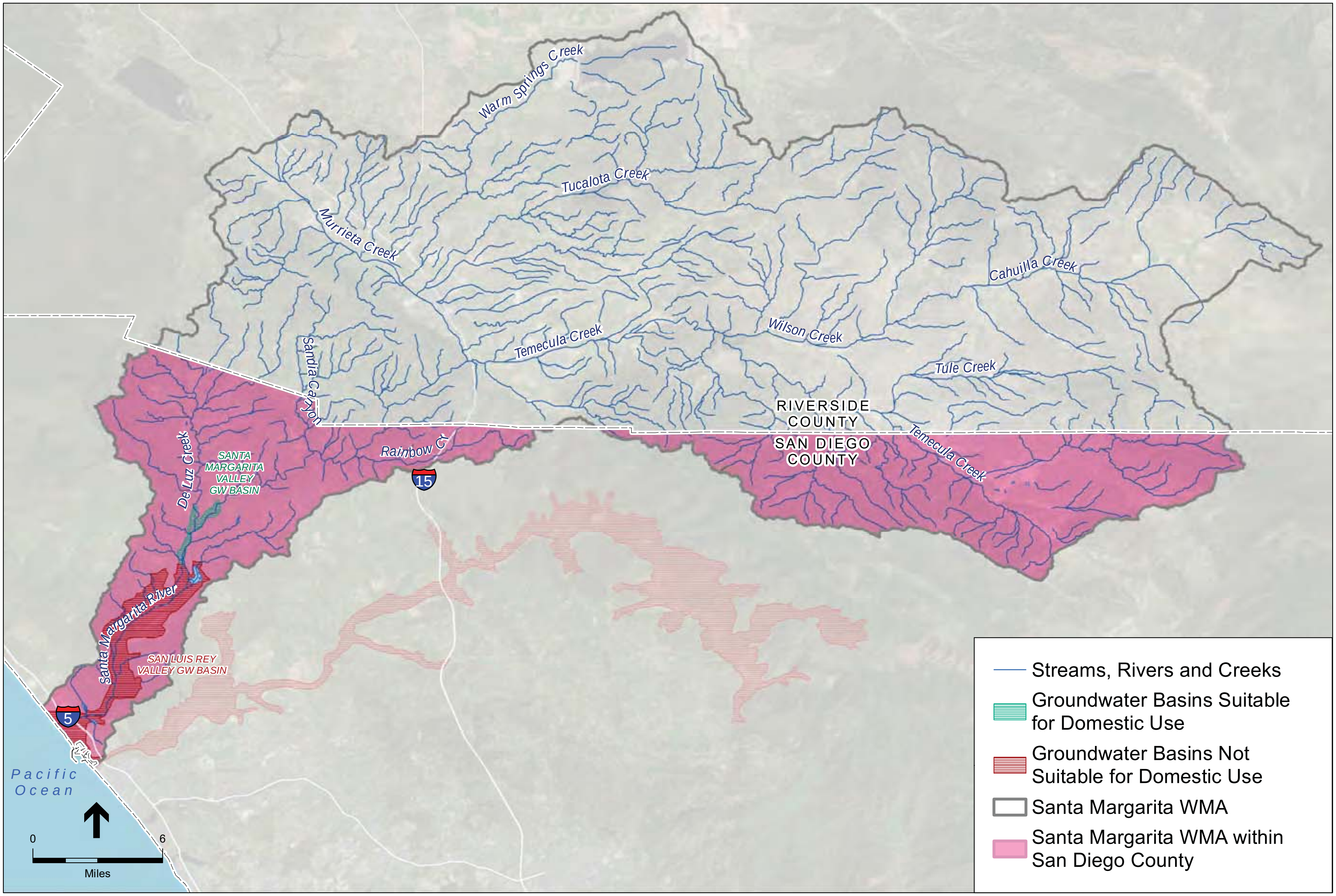




SOURCE: ESRI, 2016; SanGIS, 2016; IRWM, 2016

SCFS . 140075.20

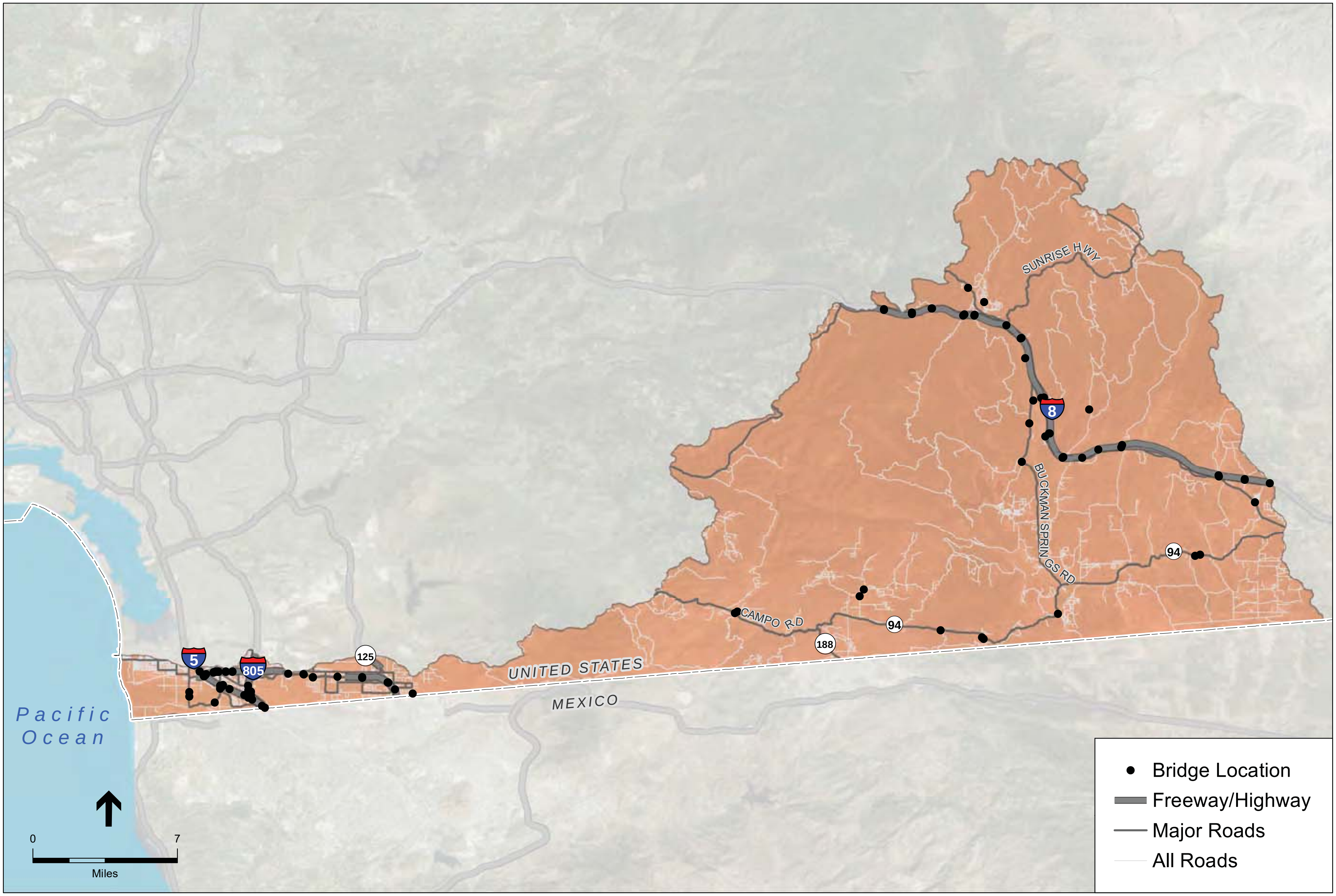
Figure **B-87**
Water Agencies and Wastewater Agencies within the Santa Margarita Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-88**
Water Features within the Santa Margarita Water Management Area

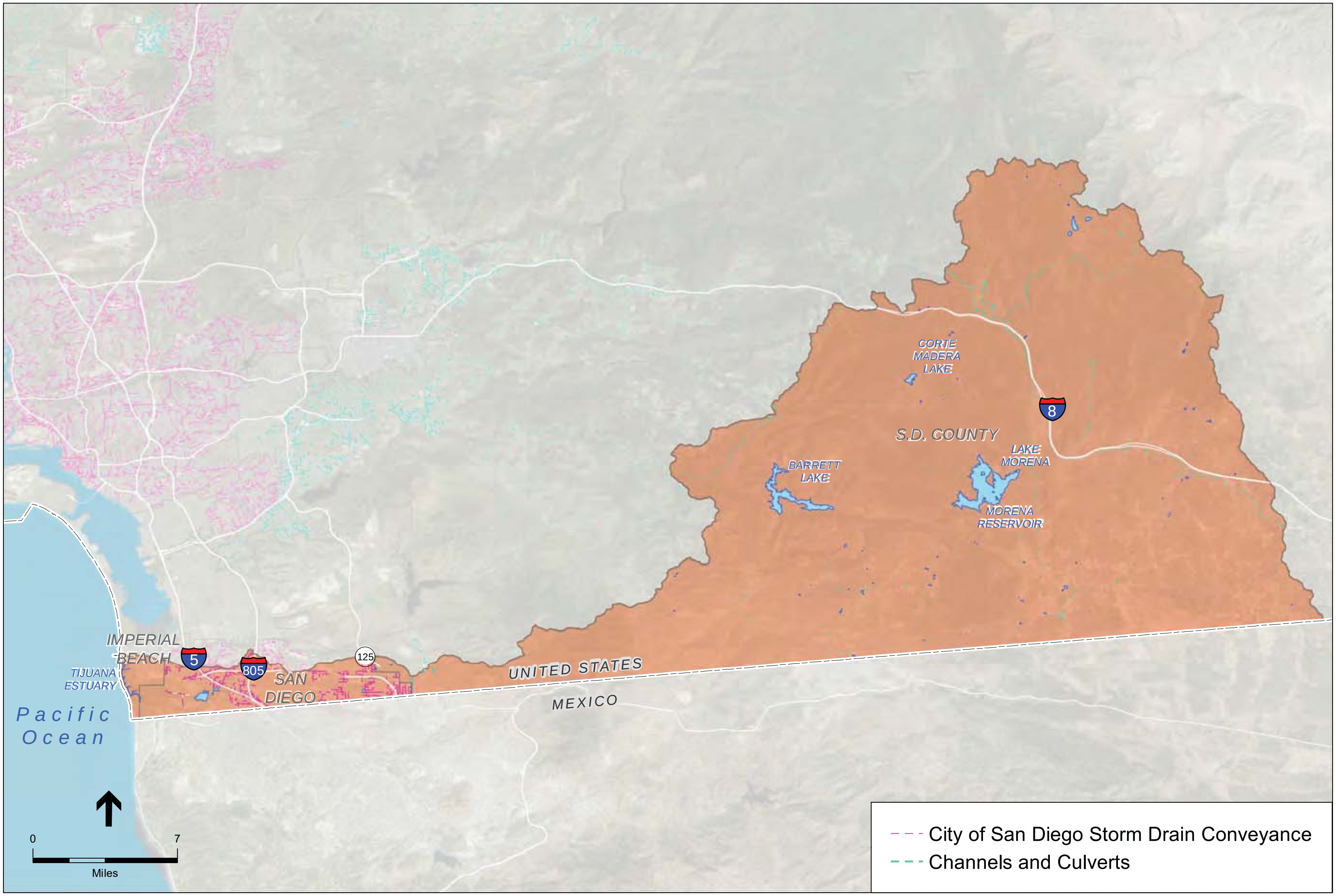


SOURCE: ESRI, 2016; SanGIS, 2016; Caltrans

SCFS . 140075.20

Figure B-89

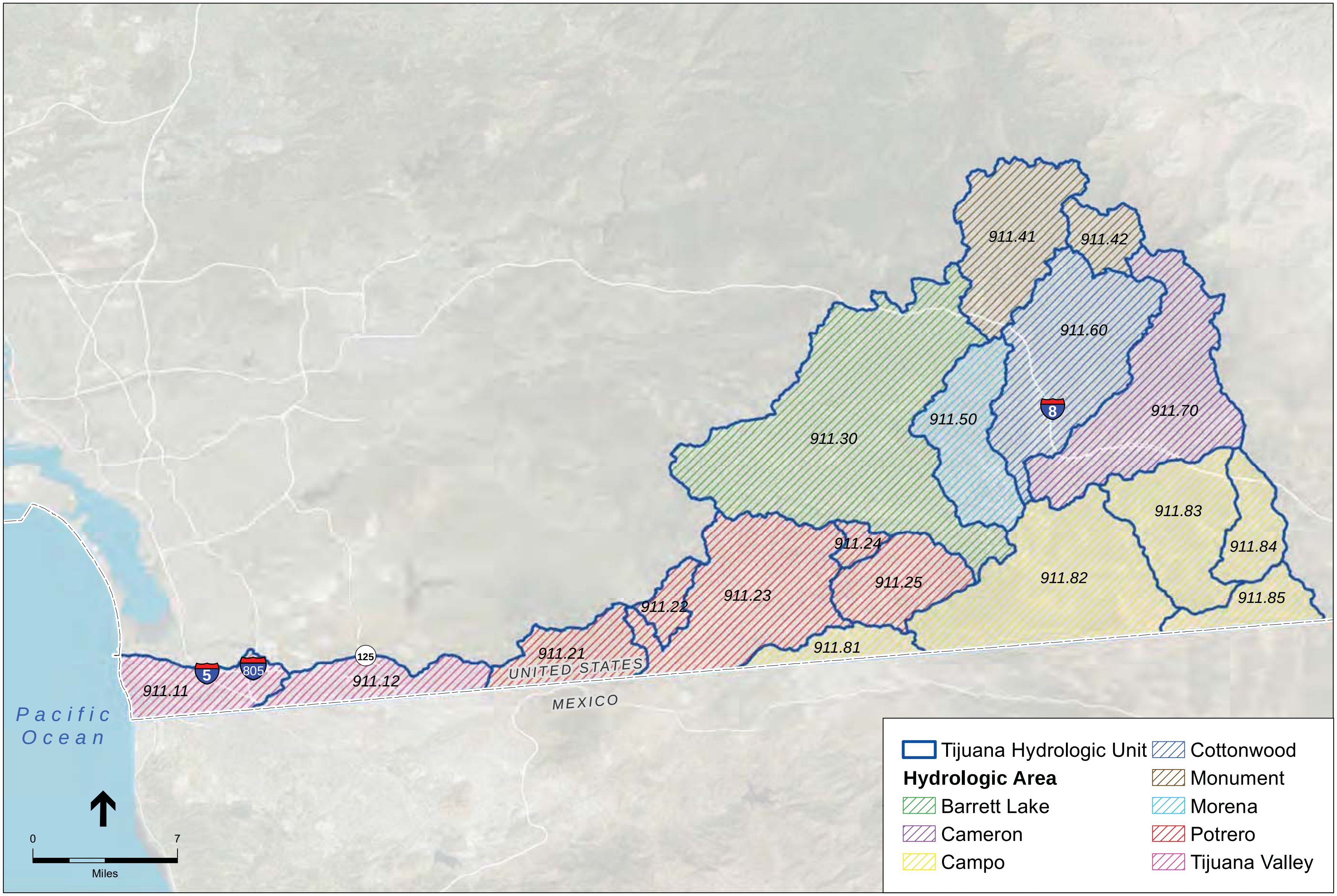
Built Environments within the Tijuana Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-90**
Flood Control System within the Tijuana Water Management Area

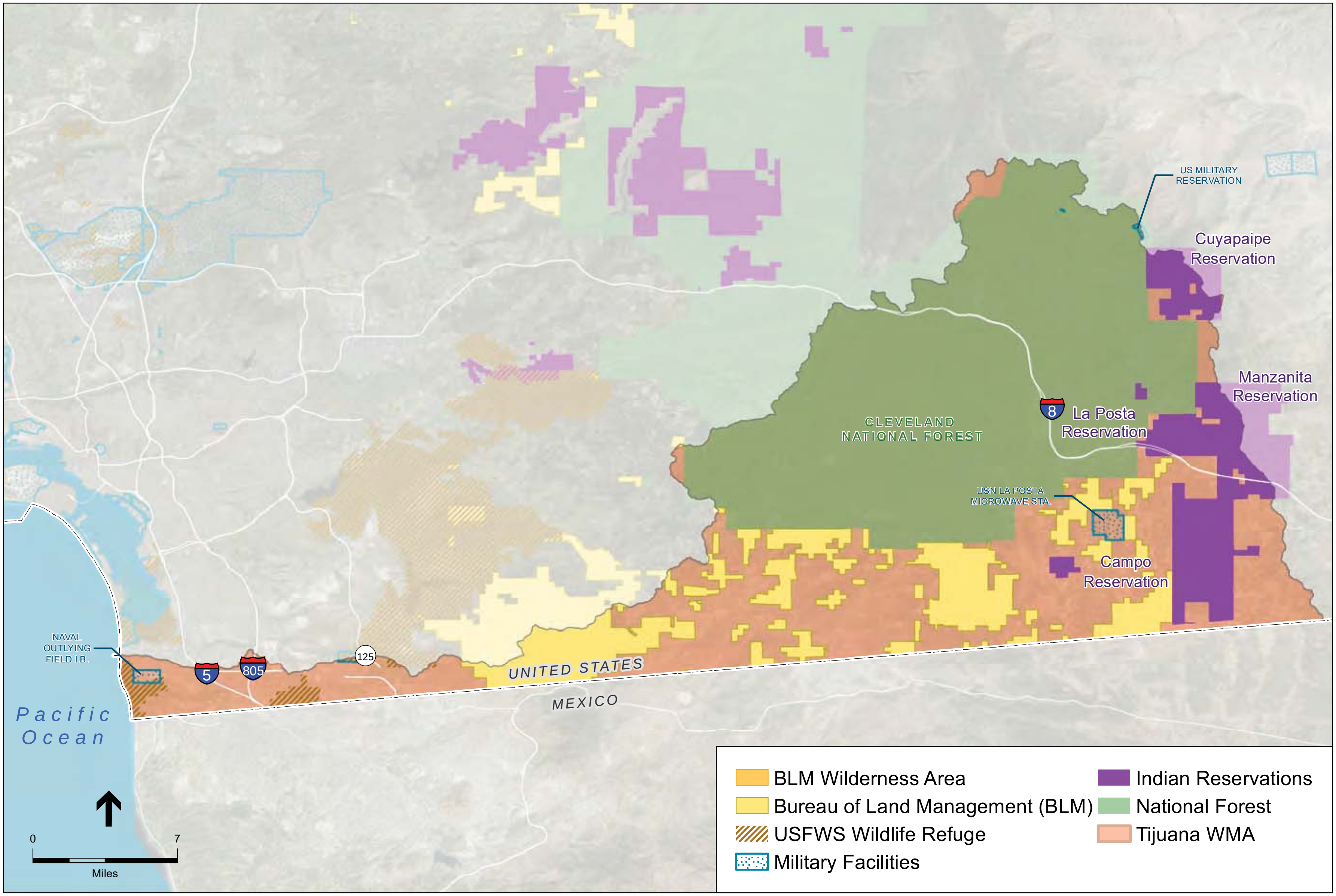


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-91

Hydrologic Units and Areas within the Tijuana Water Management Area

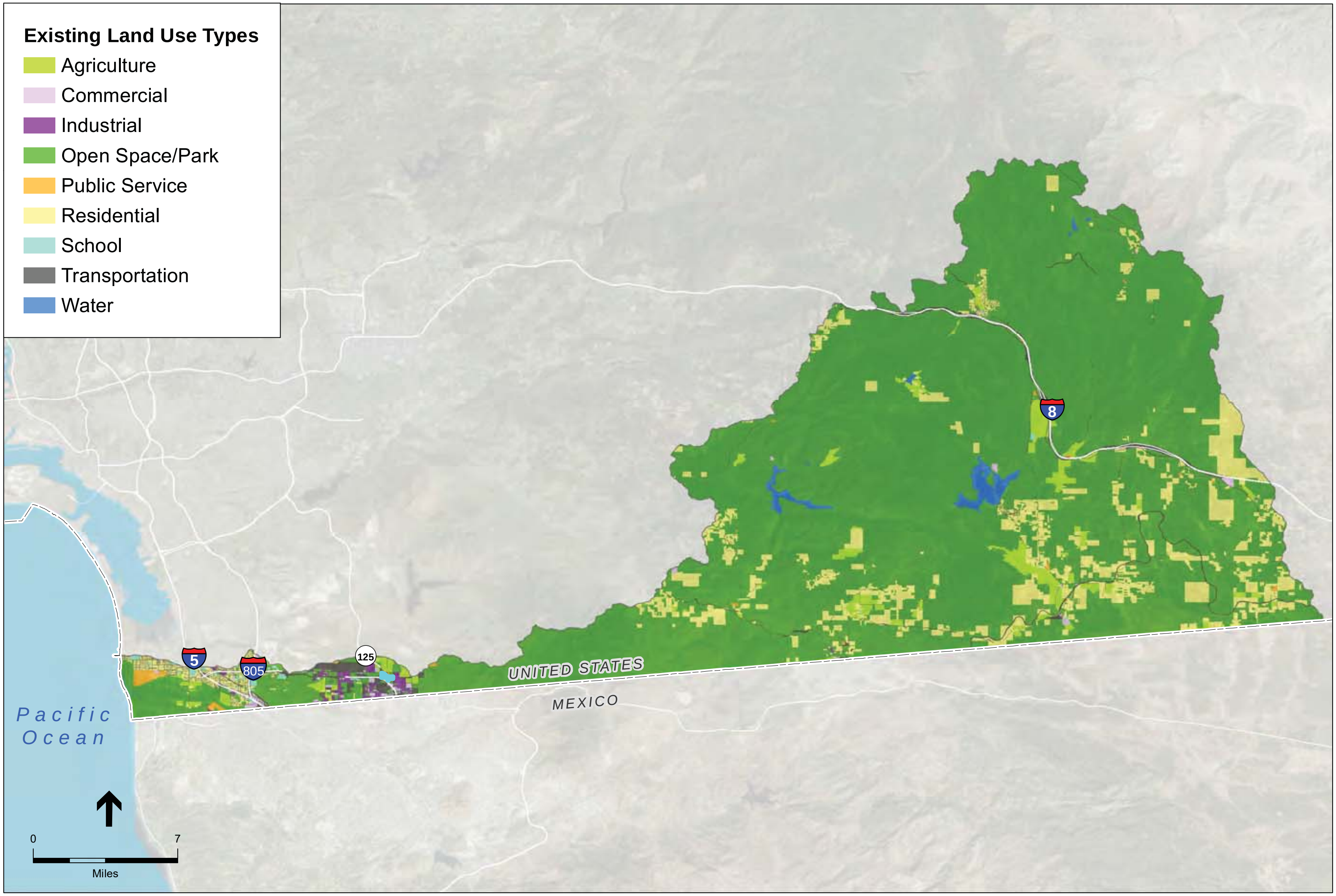


SOURCE: ESRI, 2016; SanGIS, 2016; Bureau of Land Management

SCFS . 140075.20

Figure **B-92**

Land Use Agencies within the Tijuana Water Management Area

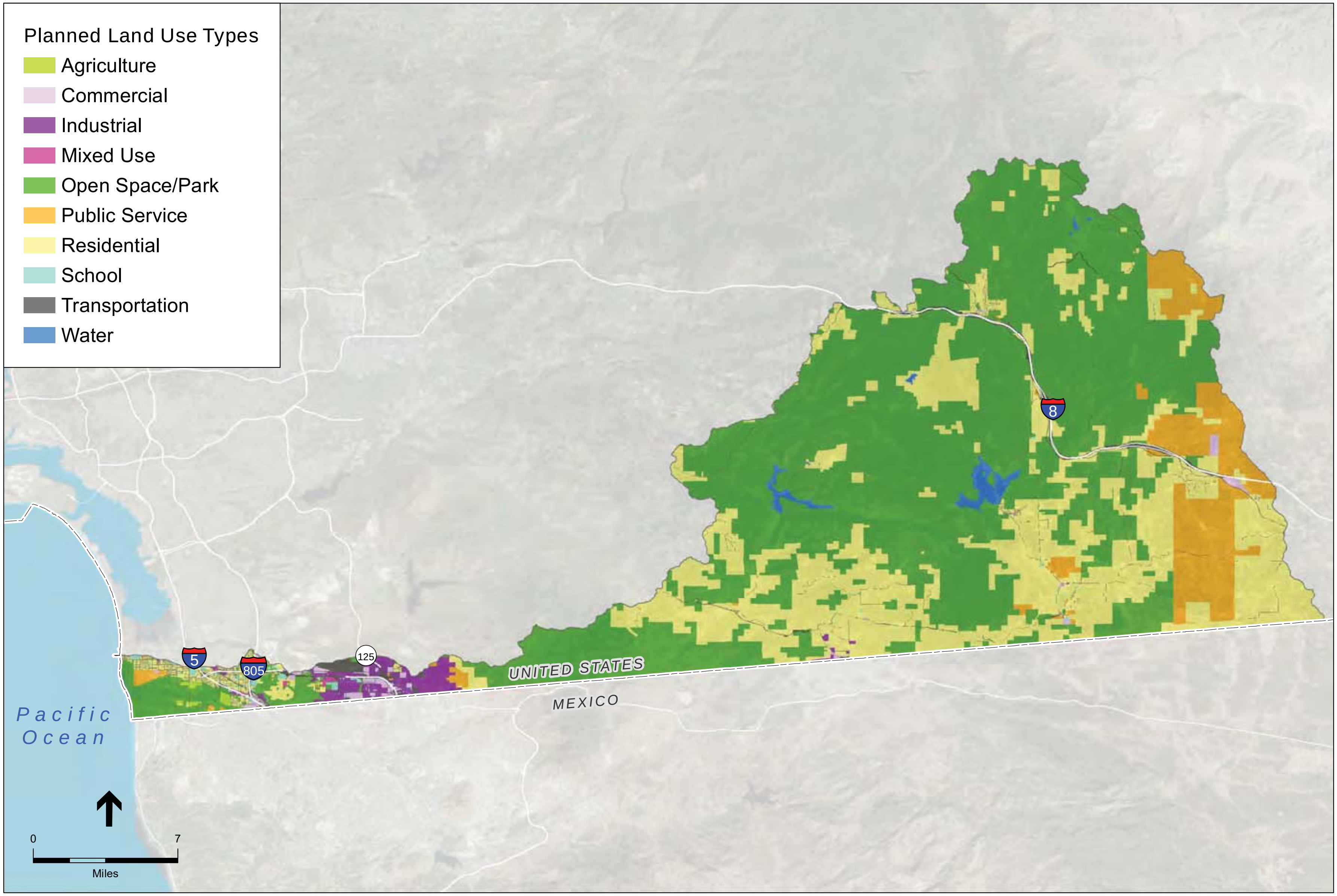


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-93

Existing Land Use within the Tijuana Water Management Area

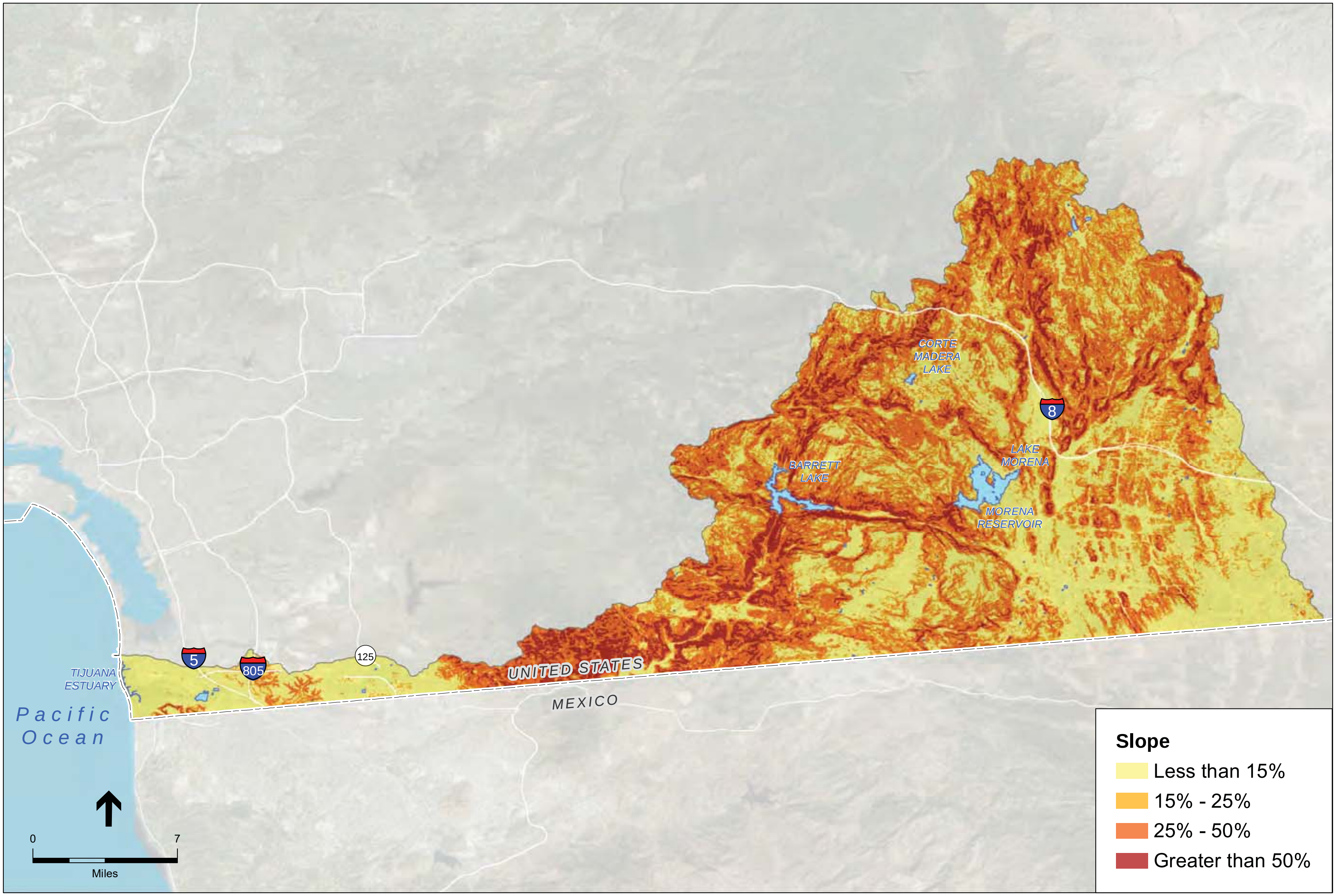


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-94**

Planned Land Use within the Tijuana Water Management Area

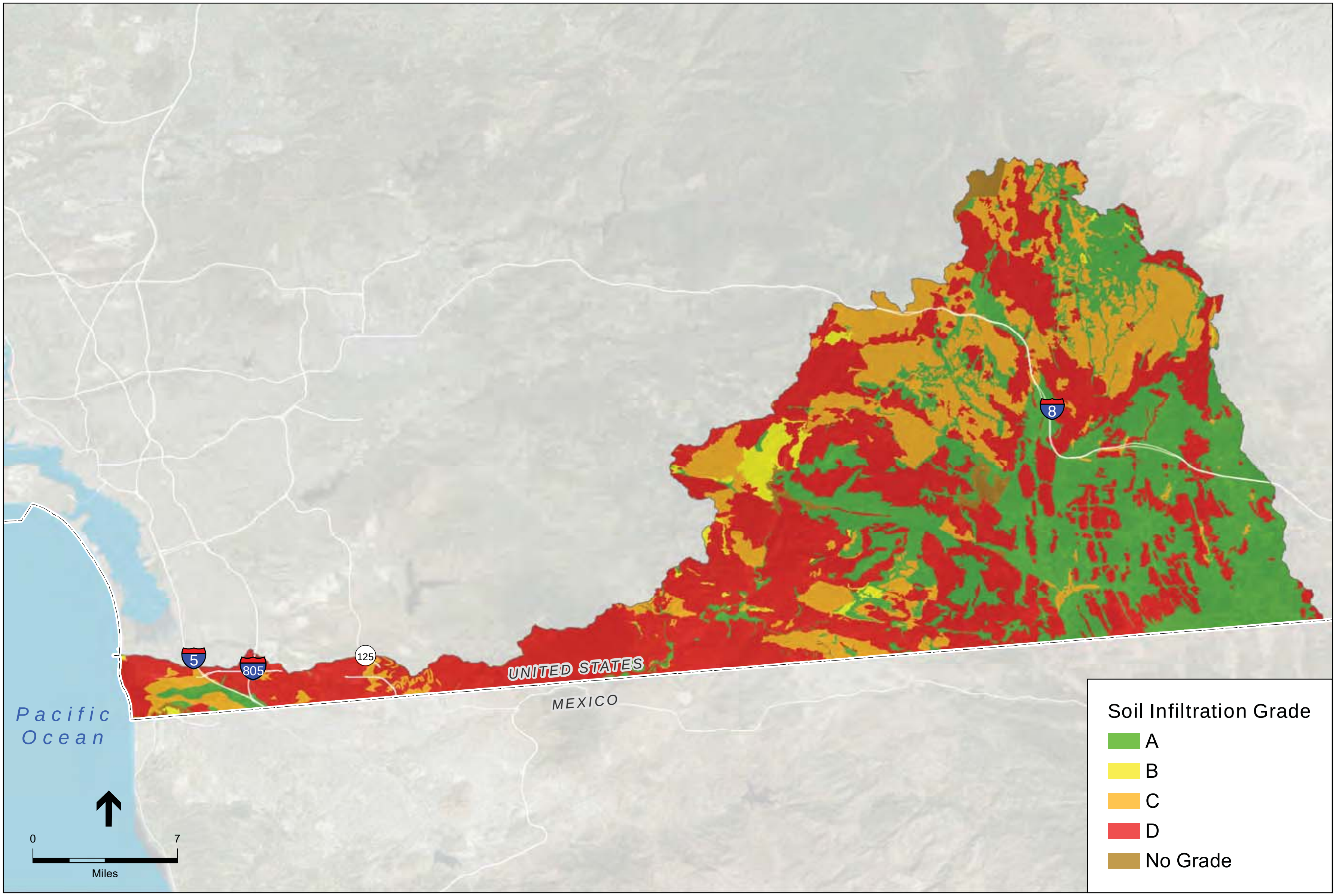


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure B-95

Slope within the Tijuana Water Management Area

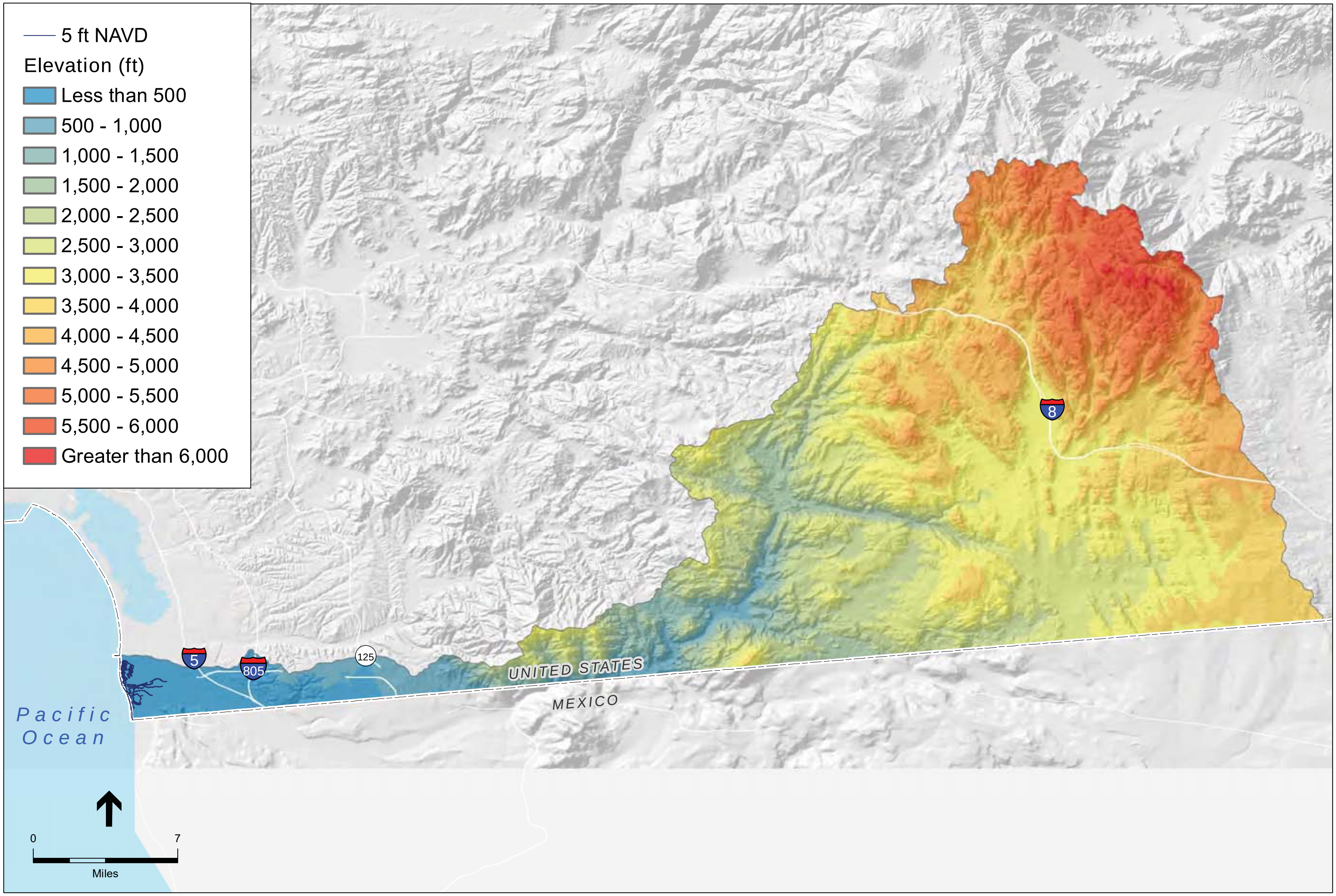


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-96**

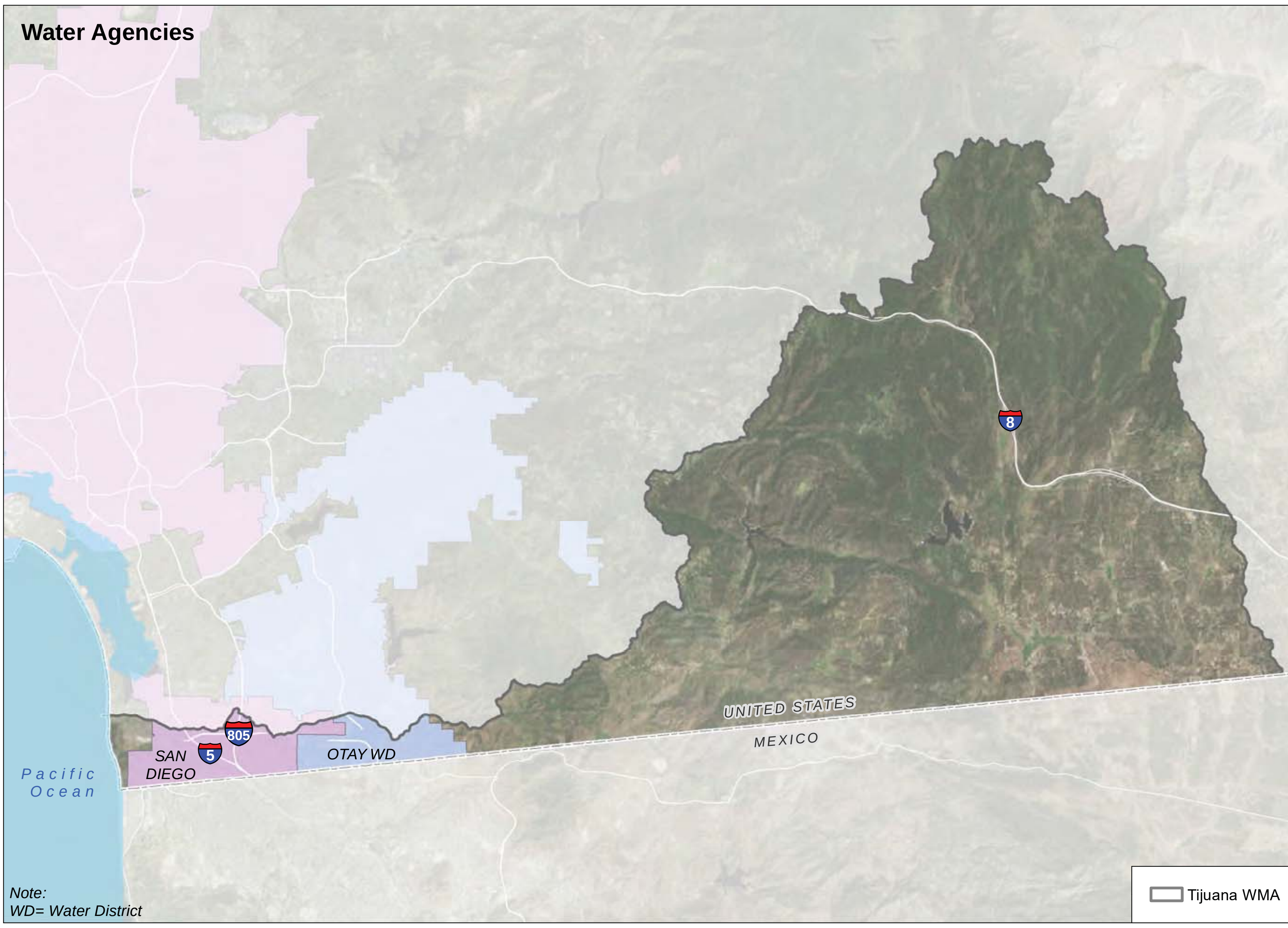
Water Features within the Tijuana Water Management Area

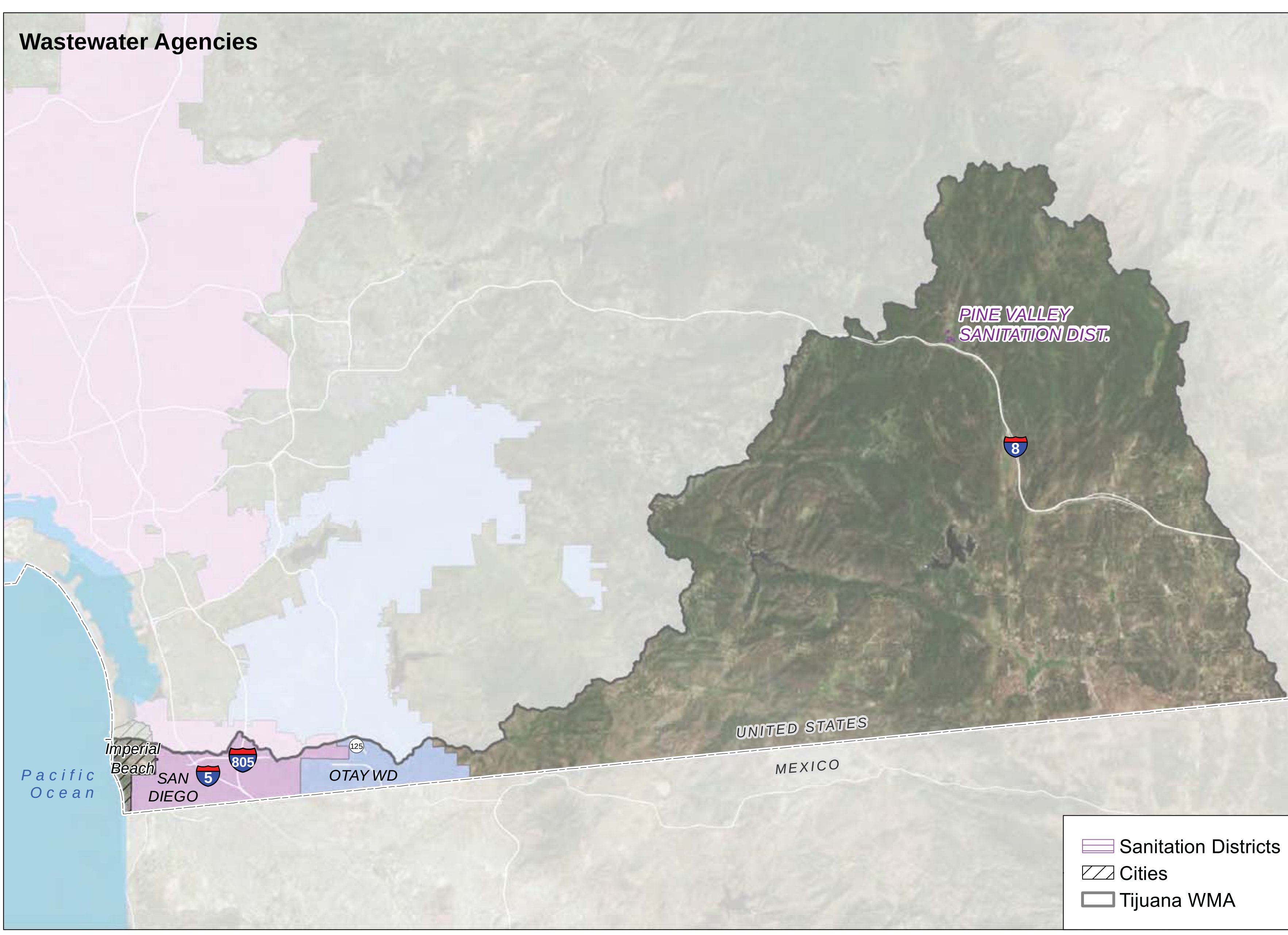


SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-97**
Topography within the Tijuana
Water Management Area



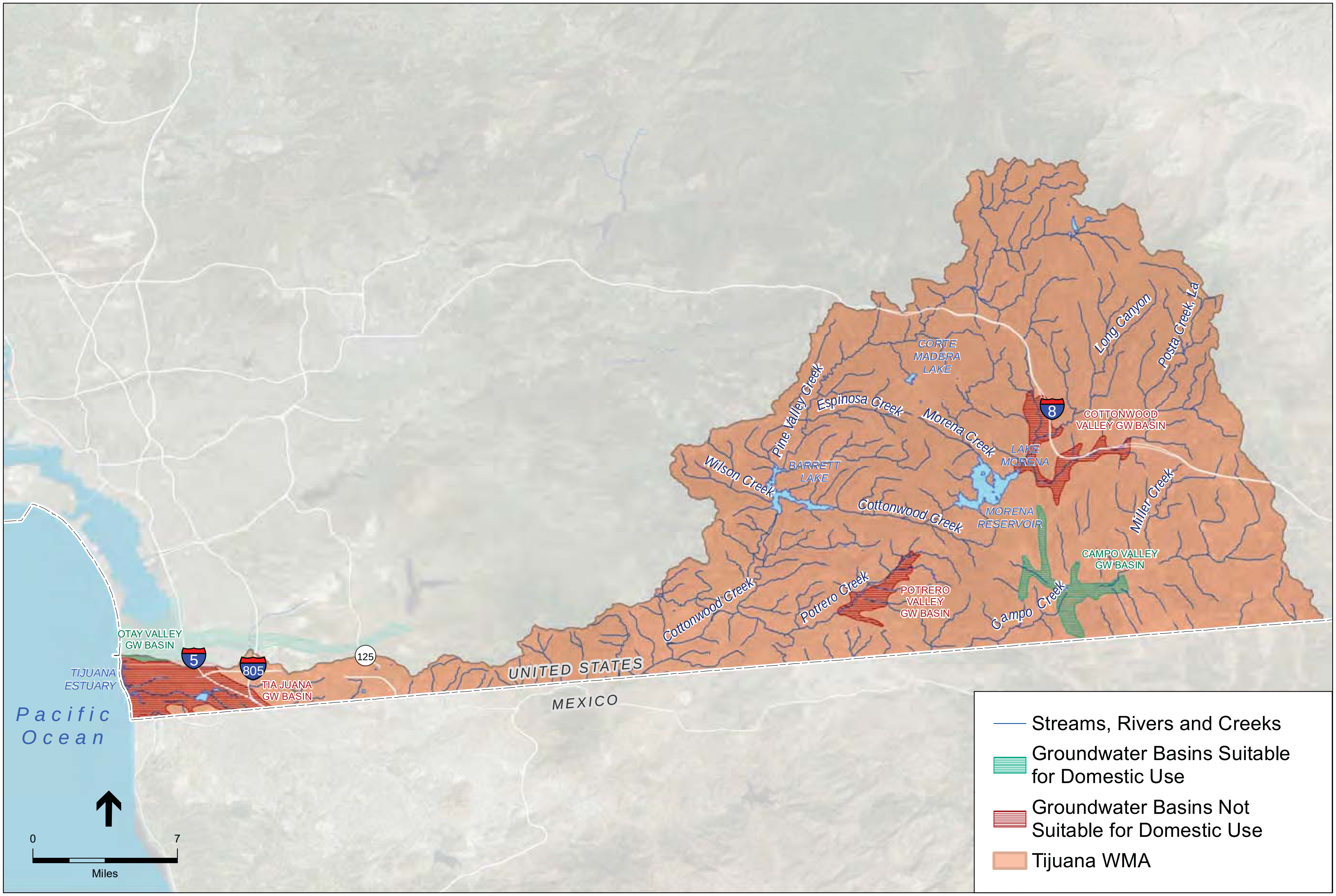


SOURCE: ESRI, 2016; SanGIS, 2016; IRWM, 2016

SCFS . 140075.20

Figure B-98

Water Agencies and Wastewater Agencies within the Tijuana Water Management Area



SOURCE: ESRI, 2016; SanGIS, 2016

SCFS . 140075.20

Figure **B-99**
Water Features within the Tijuana Water Management Area