2. REGIONAL DESCRIPTION

Los Cerritos Wetland

More than 90 percent of coastal wetlands have been eliminated in the Region. The Los Cerritos wetlands is one of the remaning few.

2.1 Introduction

The purpose of this chapter is to discuss why preparation of an IRMWP for this Region is appropriate, describe the physical characteristics of the Region, describe the sources of water and estimate water demand, identify water quality issues, and describe social trends and concerns in the Region.

2.2 Overview

Greater Los Angeles County Region

The GLAC Region, an area of approximately 2,058 square miles, is located in coastal Southern California. The Region contains portions of four counties—Los Angeles, Orange, Ventura, and San Bernardino—and is primarily defined by the coastal watersheds within the area that drain to Santa Monica Bay and San Pedro Bay. Thus, the regional boundary reflects watershed areas, which are defined by topography and include the floodplains, surface water bodies, and impaired water bodies located within those watersheds. The regional boundary is not based on 1) political or jurisdictional boundaries; 2) water, conservation, irrigation, or flood district boundaries; 3) groundwater basins; 4) the boundary of the Los Angeles Regional Water Quality Control Board; 5) major water related infrastructure; 6) population; 7) biological significant units or other biological features (critical habitat areas); or 8) disadvantaged communities with median household income demographics. Although each of those factors is relevant to the development of an integrated plan, they did not form the basis for determining the regional boundary.

The Los Angeles and San Gabriel rivers watersheds drain approximately 1,513 square miles of the Region and discharge to San Pedro Bay. These two watersheds are connected via the Rio Hondo, which transfers flood waters during large storm events from the San Gabriel to the Los Angeles River. Other major watersheds in the Region include Malibu Creek, Topanga Creek, Ballona Creek (which drain to Santa Monica Bay), and the Dominguez Channel (which drains to San Pedro Bay). Dozens of smaller watersheds drain directly to Santa Monica or San Pedro Bays. The boundaries of the GLAC Region reflect the combined area of five Watershed Management Areas (WMA) identified in the Watershed Management Initiative chapter of the Basin Plan for Los Angeles and Ventura Counties, prepared by the Los Angeles Regional Water Quality Control Board. These are the Los Angeles River Watershed, the San Gabriel River Watershed, the Santa Monica Bay WMA, the Los Cerritos Channel/Alamitos Bay WMA, and the Dominguez Channel WMA.

How the Boundary Facilitates Integrated Water Management

Given the Region's substantial reliance on local surface water supplies (and the groundwater recharge that results) and the extensive range of surface water quality impairments, the aggregation of coastal watersheds to form the GLAC Region is logical and an appropriate scale for integrated water management. These coastal watersheds share many of the same water resource management issues, including substantial dependence on imported water, significant opportunities to further expand water conservation, and substantial utilization of recycled water. Water resource management planning at this scale provides an opportunity to optimize use of local water resources including stormwater runoff, recycled water, and groundwater to reduce dependence on imported water and concurrently enhance water supply reliability. Thus, the selection of a regional boundary based on coastal watershed boundaries facilitates the development of an integrated water supply portfolio that relies on multipurpose projects and programs to address similar water management issues. With so many agencies and jurisdictions responsible for water management in the GLAC Region, the development of an IRWM Plan has not resolved or eliminated every potential conflict in a region of more than 2,000 square miles. However, the development of the IRWM Plan, ongoing meetings to discuss common issues and concerns, identification and integration of multi-purpose projects, and

Steep mountain slopes and adjacent flatlands create both challenges and opportunities for water resource management .

collaborative efforts to increase opportunities to fund those projects, has greatly enhanced the willingness of these entities to seek mutually beneficial solutions to problems that historically were a source of conflict.

Subregional Characteristics

Given the size and complexity of the GLAC Region and the number of stakeholders and agencies that could participate in Plan development and other planning activities, to manage stakeholder input and acknowledge geographic variation, five subregional planning areas were established, as discussed in Chapter 1.

Lower San Gabriel and Los Angeles Rivers Subregion

The Lower SG & LA is comprised of 37 cities, 27 in the Gateway IRWM Region and 10 in the Santa Ana Watershed Project Authority IRWM Region (which includes the Orange County portion of the Coyote Creek watershed). Dozens of water agencies/companies and other entities which have an interest in a variety of water management issues serve the Lower SG & LA's three million residents. The Lower SG & LA faces significant ground and surface water quality challenges, as well as flood control issues, due to its location in the lower reaches of two major watersheds and intense urban development changes.

It has the greatest water recharge capacity in the GLAC Region due to the recharge basins in the vicinity of the Whittier Narrows. Further, it has the most densely developed commercial and industrial land uses coupled with the least amount of open space on a per acre basis in the GLAC Region; notably several cities in the Lower SG & LA are over 100 years old. Further, the Lower SG & LA is in the lower reaches of a vast metropolitan area and, therefore has significant water quality issues along with tremendous opportunities for conjunctive use, recycled and reclaimed water use, desalination and wetlands restoration in the estuaries of the San Gabriel River and Los Angeles River. The cities in the Lower SG & LA face many competing financial needs, including complying with stormwater regulations, replacing aging infrastructure, providing affordable housing and increasing public safety. A considerable number of the cities have experienced and will continue to experience severe funding shortages for infrastructure repair, maintenance and installation along with high household poverty rates.

The Los Angeles River is fed by the largest drainage area in the Region.

North Santa Monica Bay Subregion

The North SM Bay differs substantially from the other Subregions with respect to land use, water supply, groundwater and surface water quality, aquatic resources, open space and recreation. Over 85 percent of the North SM Bay is still undeveloped open space; remaining land uses in the area are primarily residential and concentrated along the coastline and interior valleys where its 107,000 residents reside. There is little heavy industry. The North SM Bay depends almost entirely on imported water due to naturally-poor groundwater quality and limited surface storage opportunities. Per capita recycled water use is among the highest in the nation, but further expansion is limited to areas that are difficult to reach due to steep mountain slopes. Aquatic habitat protection and restoration is a special priority, as the North SM Bay includes the Santa Monica Mountains National Recreation Area, several State Parks, a state designated ASBS, and Malibu Lagoon, all heavily used for recreation. The North SM Bay is also home to over a dozen endangered and threatened species, including the southernmost Steelhead Trout population in the state.

South Bay Subregion

The South Bay consists of three defining characteristics—its coastline, its population and its industry. More than 30 miles of coastline in the South Bay attract tens of millions of visitors to Southern California every year, serve as an important recreation area for the area's residents both rich and poor, and in a few remaining pockets such as the Palos Verdes Peninsula, Madrona Marsh, Ballona Wetlands, portions of the Santa Monica Mountains and Baldwin Hills, support a diverse population of birds and other wildlife. With over 2.6 million residents, the South Bay is one of the most dense and economically diverse urban areas of the Region, creating both challenges to preserve and enhance local water resources and the natural environment as well as unique opportunities for collaboration. The South Bay's industries--oil refining, power generation, and transportation via the Port of Los Angeles, Los Angeles International Airport and major freeways—provide similar challenges and opportunities.

Upper Los Angeles River Subregion

The Upper LA Subregion is home to approximately 2.3 million residents, mostly in development concentrated in the interior valleys and the foothills, which are generally surrounded by large expanses of open space in the San Gabriel, Verdugo, Santa Monica, and Santa Susanna Mountains. In most years, the mountains generate substantial runoff, much of which can be recharged into the underlying groundwater basins via favorable soils along the major channels and on the valley floors. The large expanses of urban and suburban development on the valley floors, and significant residential development in canyons and associated hillsides, have resulted in the channelization of most of the major river and stream channels and contributed to degraded surface water quality in those channels. Restoration or enhancement of several major channels, including the Los Angeles River, provides opportunities to improve water quality, enhance water supplies and restore habitat.

Upper San Gabriel and Rio Hondo Subregion

The Upper SG & RH Subregion contains large expanses of open space in the San Gabriel Mountains (including much of the Angeles National Forest) and the Puente, and San Juan Hills, with development concentrated in the interior valleys and the surrounding foothills. Several groundwater basins, including the vast San Gabriel basin, and runoff from the San Gabriel Mountains provide significant water supplies, although groundwater contamination from industrial sources and prior land uses poses a significant challenge in some locations. The large expanses of urban and suburban development on the valley floors are home to approximately 1.5 million residents. Although most of the major river and stream channels on the valley floors have been subject to channelization, several of these, including the San Gabriel River, have natural bottoms, which promote in-stream percolation of runoff.

Neighboring/Overlapping IRWM Efforts

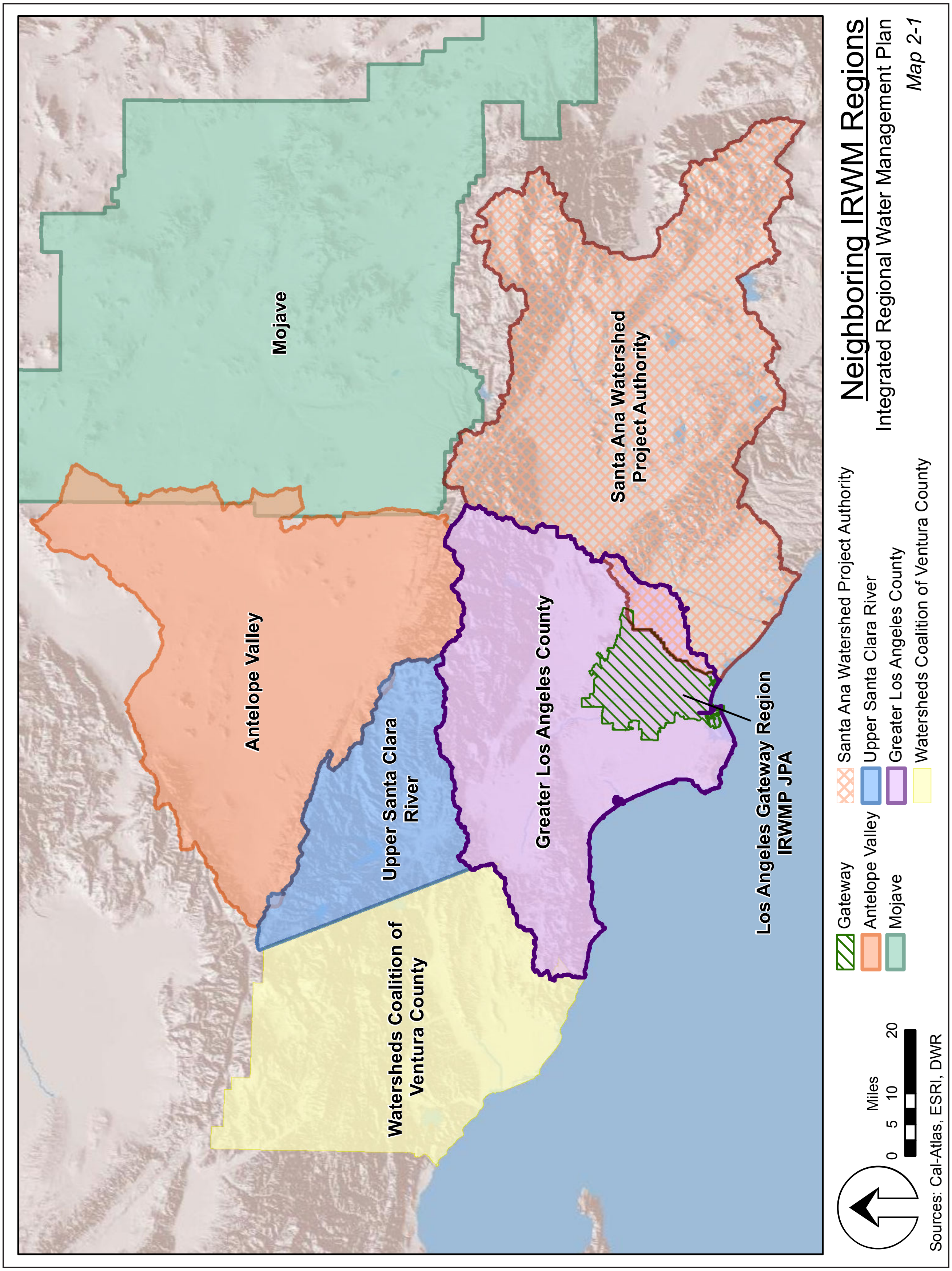
As shown in Map 2-1, the Region is bordered and/or overlapped by six other IRWM Planning Regions:

- Watersheds Coalitions of Ventura County (which consolidated the Ventura County and Calleguas Creek Watershed efforts) on the west
- Santa Ana Watershed Project Authority to the south
- Upper Santa Clara River to the northwest and Antelope Valley to the northeast
- Mojave Water Agency's Regional Water Management Planning Area is located to the northeast of the Region
- Los Angeles Gateway Water Management Authority Region (Gateway Region) overlaps the southern portion of the Region (portions of the Lower SG & LA Subregion)

During the development of the 2006 adopted Plan and throughout the first two years of the IRWM planning activities in the GLAC Region, each of the Subregions benefited from the widespread participation of agencies, jurisdictions, organizations, and many individuals from within those subregions. In 2008, several jurisdictions in the Lower SG & LA Subregion elected to form a Joint Powers Authority (JPA) for the purposes of establishing the Los Angeles Gateway Region, out of a concern about the appropriate scale for regional planning. This effort resulted in a decline in participation by members of the JPA and other cities represented by the Gateway Cities COG, although the remaining steering committee members have continued to meet and be engaged. In response, the LACFCD and members of the LC and the SC of the Lower SG & LA Rivers Subregion engaged in various efforts to encourage members of the Gateway Cities COG and the Los Angeles Gateway Region IRWM JPA to more fully engage in ongoing planning activities in the GLAC Region, including the potential for expanded planning at a subregional scale.

In June 2008, in a letter from DWR Director Lester Snow, DWR encouraged the GLAC Region and members of the Gateway Region JPA to work together to resolve issues and concerns. Subsequently, the Chair and members of the Steering Committee for the Lower SG & LA Subregion, along with the LACFCD, redoubled their efforts to engage participants in the Gateway Region JPA effort to encourage their continued participation in the GLAC planning process. Since that time, participation in the Steering Committee has improved, but has not entirely rebounded to the level prior to the Gateway Region JPA efforts. It is hoped that these entities will continue to participate in the GLAC planning process and that their participation will continue to expand.

There is an overlap between the GLAC and the SAWPA Regions. Thus, projects located within the overlap area could appear in either region's list of projects, as deemed appropriate. In addition, it has been acknowledged that the inclusion of any projects (in the overlap area) in an implementation grant application would require close coordination to assure that a duplicate project submission does not occur. The LACFCD and members of the LC and the SC of Lower SG & LA Subregion have been engaged in various efforts to encourage members of the Gateway Cities COG and the Gateway Region JPA to more fully participate in ongoing planning activities in the GLAC Region.


Mojave
Antelope Valley
Upper Santa Clara River
Greater Los Angeles County
Santa Ana Watershed Project Authority
Watersheds Coalition of Ventura County
Los Angeles Gateway Region IRWMP JPA
Gateway
Antelope Valley
Mojave
Santa Ana Watershed Project Authority
Upper Santa Clara River
Greater Los Angeles County
Watersheds Coalition of Ventura County
Neighboring IRWM Regions
Integrated Regional Water Management Plan
Map 2-1
Miles
0 5 10 20
Sources: Cal-Atlas, ESRI, DWR

2.3 Physical Setting

Geology and Geomorphology

The geography of the Region can generally be divided into four distinct types: the coastal plain, inland valleys (e.g., San Fernando, San Gabriel, Pomona, and Walnut), foothills that generally surround the valleys, and two mountain ranges (the Santa Monica and San Gabriel Mountains). These mountains are part of the Transverse Ranges, which extend 350 miles east to west from the Eagle Mountains in San Bernardino County to the Pacific Ocean. To the north, the San Gabriel Mountains separate the Los Angeles basin from the Mojave Desert. To the west, the Santa Monica Mountains separate the Los Angeles basin from the Ventura basin. Topography in the Region ranges from sea level to over 10,000 feet in the San Gabriel Mountains. Most of the coastal plain is less than 1,000 feet in elevation. The foothills reach 3,000 to 4,000 feet before rising rapidly into the San Gabriel Mountains, to a height of 10,064 feet at Mount San Antonio (or Mount Baldy). The grade of the mountain slopes in the San Gabriel Mountains average 65 to 70 percent, some of the steepest slopes in the world.

Geology varies from Precambrian metamorphic rocks (1.7 billion years old) to alluvial deposits washed down from mountain canyons. The San Gabriel Mountains are young mountains, geologically speaking, and continue to rise at a rate of nearly three-quarters of an inch per year. Because of this instability, they are also eroding at a rapid rate. Alluvial deposits of sand, gravel, clay and silt in the coastal plain are thousands of feet thick in some areas, due in part to the erosive nature of the San Gabriel and Santa Monica Mountains.

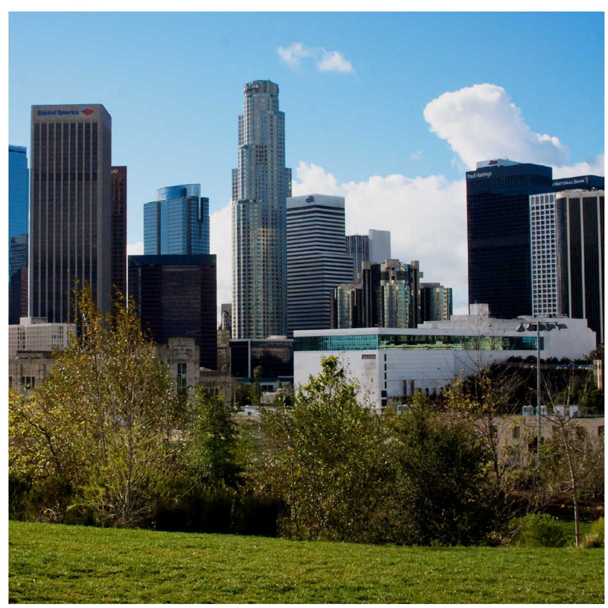
The Region is extensively faulted, with the San Andreas Fault bordering the north side of the San Gabriels and the Sierra Madre–Cucamonga fault zone on the south side. Throughout the Region are hundreds of lesser fault systems, such as the Newport-Inglewood fault that runs from Newport Beach to Beverly Hills via Long Beach and Signal Hill. The most notorious are those that have been the cause of major earthquakes during the past few decades, known not by name but by the area in which they struck: Sylmar in 1971, Whittier Narrows in 1987, and Northridge in 1994.

Climate

The Region is within the Mediterranean climate zone, which extends from Central California to San Diego and is characterized by winter precipitation followed by dry summers.

The geography of the Los Angeles Region results in a great deal of spatial variation in the local climate. The abrupt rise of the mountains from the coast creates a barrier that traps moist ocean air against the southerly slopes and partially blocks the desert summer heat and winter cold from the interior northeast. The common perception of the Region as desert is misleading. The coastal plain may be more appropriately termed "semi-arid," although portions of the San Gabriel Mountains receive considerable snow and rainfall most years.

Summers are dry, with most precipitation falling in a few major storm events between November and March. Long-term annual rainfall averages vary from 12.2 inches along the coast, 15.5 inches in downtown Los Angeles to 27.5 inches in the mountains. The maximum-recorded 24-hour rainfall in the Region is 34 inches in the mountains and 9 inches in the coastal plain.



The Region is a Mediterranean climate with winter precipitation followed by dry summers.

2.4 Internal Boundaries

The Region has a variety of internal boundaries that have been defined for different purposes. In many cases, these boundaries overlap. This section describes the different sets of internal boundaries: subregional (described previously), watersheds, political jurisdictional, water supply, wastewater service, flood control districts, and land use agencies.

Subregional Boundaries

As previously described, the Region is composed of five subregions based on Watershed boundaries (refer to Map 2-2):

- Lower San Gabriel and Los Angeles Rivers;
- North Santa Monica Bay;
- South Bay;
- Upper Los Angeles River; and
- Upper San Gabriel River and Rio Hondo River.

Watershed Boundaries

Within the Region, there are over one hundred institutions that provide water services or manage groundwater resources. The general boundaries of each Subregions' retail water districts and city-operated water agencies are shown on Maps 2-3(a) through 2-3(e), while the boundaries for wholesale water suppliers are shown in Maps 2-4(a) through 2-4(e). Small retail water suppliers are not shown.

Political Jurisdictional Boundaries

The Region includes portions of 4 counties and 92 cities. Maps 2-5(a) through 2-5(e) depict the county and city boundaries within each of the five Subregions.

Land Use Agency Boundaries

Land use policy within the Region is established by cities, and, where unincorporated areas exist, by counties. Each city and county establishes its own General Plan to establish the uses of land for housing, business, industry, open space, and other uses. City and county boundaries are depicted in Maps 2-5(a) through 2-5(e).

Wastewater Service Boundaries

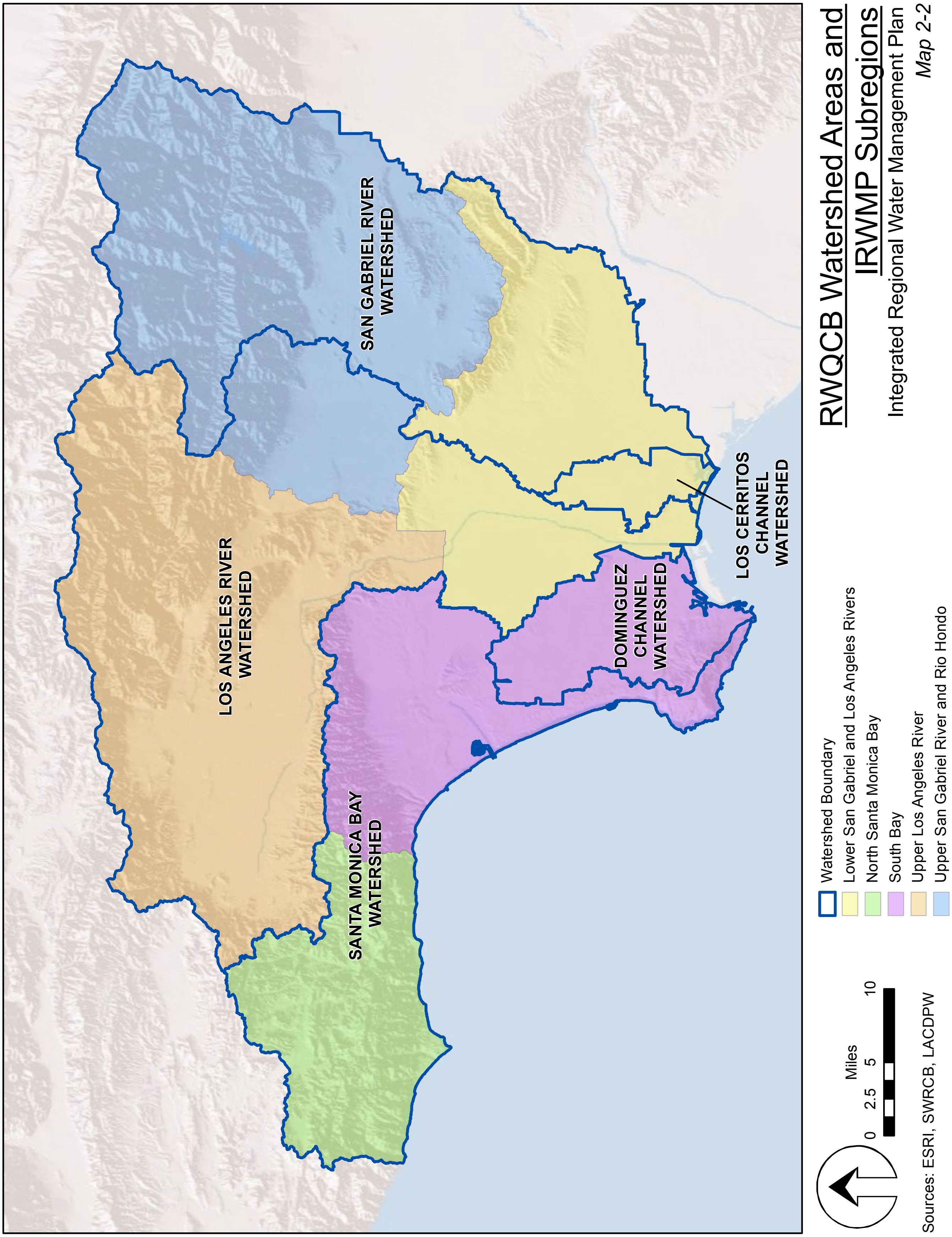
Wastewater service in the Region is provided by a number of entities which include sanitation districts, water districts and cities. A vast majority of the Region's wastewater service is collected and treated by those entities shown in Map 2-6. It should be noted that while the entities shown in the map cover a majority of the Region, the cities and water districts within the larger service areas may collect and treat their own wastewater, then utilize the outfall systems of the larger entities. Very few areas in the Region (where septic systems are in use) do not utilize wastewater service providers.

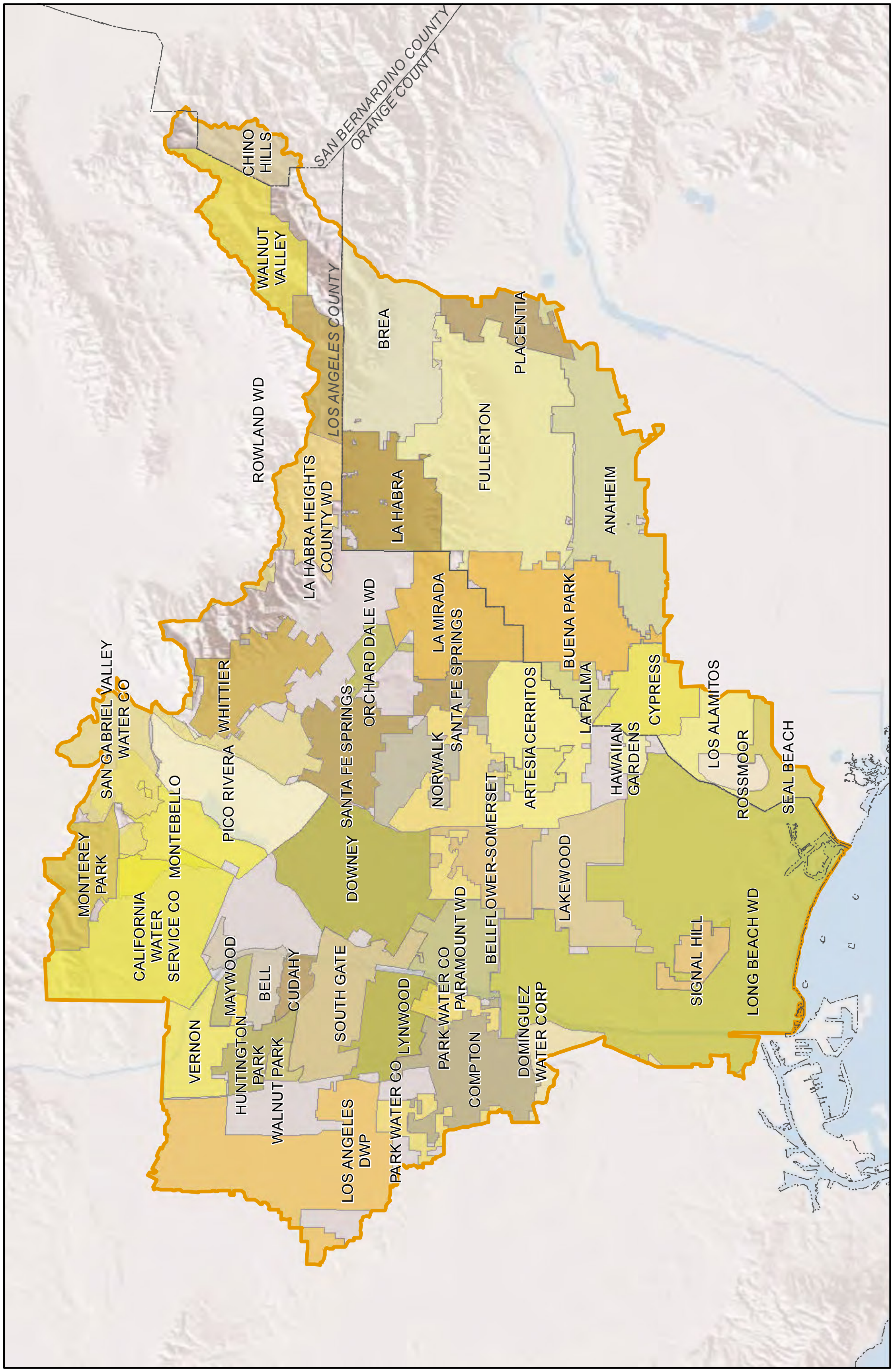
Flood Control District Boundaries

Flood control is primarily managed by county agencies within the Region, and includes flood control districts for Los Angeles County, Ventura County, Orange County and San Bernardino County. These agencies, in association with the Army Corps, construct, manage and maintain the Region's flood infrastructure, such as debris basins, storm drains, culverts, dams, reservoirs, spreading basins, and flood control channels. Map 2-7 depicts flood control district and subregional boundaries.

Groundwater Basin Boundaries

Groundwater basins within the Region are defined both geologically and along political boundaries. Geological boundaries are generally defined by fault lines or surface features such as mountains, while political boundaries are typically county lines. Map 2-8 depicts groundwater basins within the Region.


RWQCB Watershed Areas and IRWMP Subregions
Integrated Regional Water Management Plan
Map 2-2
SAN GABRIEL RIVER WATERSHED
LOS ANGELES RIVER WATERSHED
SANTA MONICA BAY WATERSHED
DOMINGUEZ CHANNEL WATERSHED
LOS CERRITOS CHANNEL WATERSHED
Watershed Boundary
Lower San Gabriel and Los Angeles Rivers
North Santa Monica Bay
South Bay
Upper Los Angeles River
Upper San Gabriel River and Rio Hondo
Miles
0 2.5 5 10
Sources: ESRI, SWRCB, LACDPW



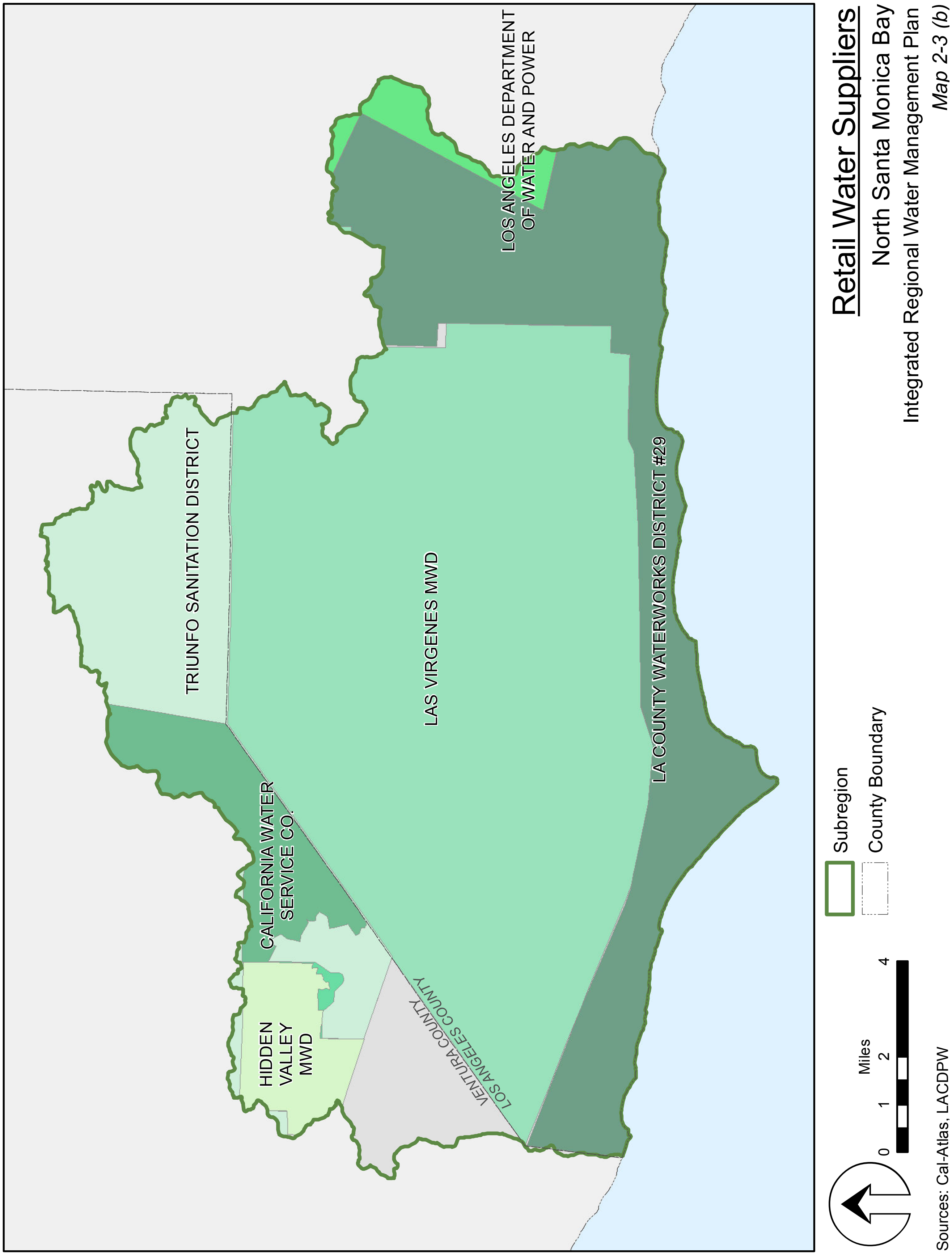
Subregion
County Boundary

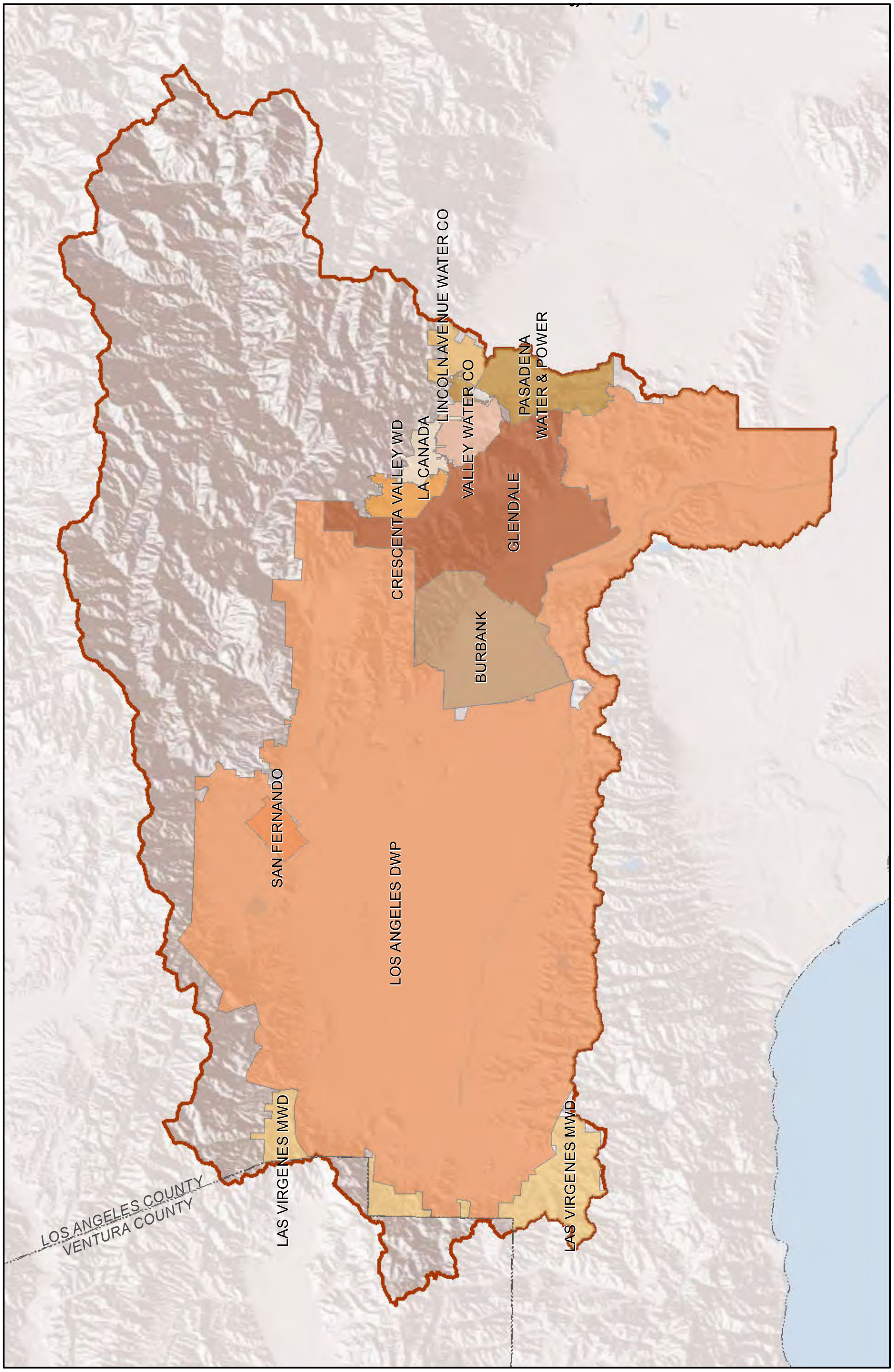
Miles
0 1 2 4

Retail Water Suppliers

Lower San Gabriel & Lower Los Angeles Rivers Subregion
Integrated Regional Water Management Plan
Map 2-3 (a)

Sources: Cal-Atlas, LACDPW


Retail Water Suppliers
North Santa Monica Bay
Integrated Regional Water Management Plan
Map 2-3 (b)
LOS ANGELES DEPARTMENT OF WATER AND POWER
TRIUNFO SANITATION DISTRICT
LAS VIRGENES MWD
LA COUNTY WATERWORKS DISTRICT #29
CALIFORNIA WATER SERVICE CO.
HIDDEN VALLEY MWD
VENTURA COUNTY
LOS ANGELES COUNTY
Subregion
County Boundary
Miles
0 1 2 4
Sources: Cal-Atlas, LACDPW



Subregion
County Boundary

Miles
0 1.25 2.5 5

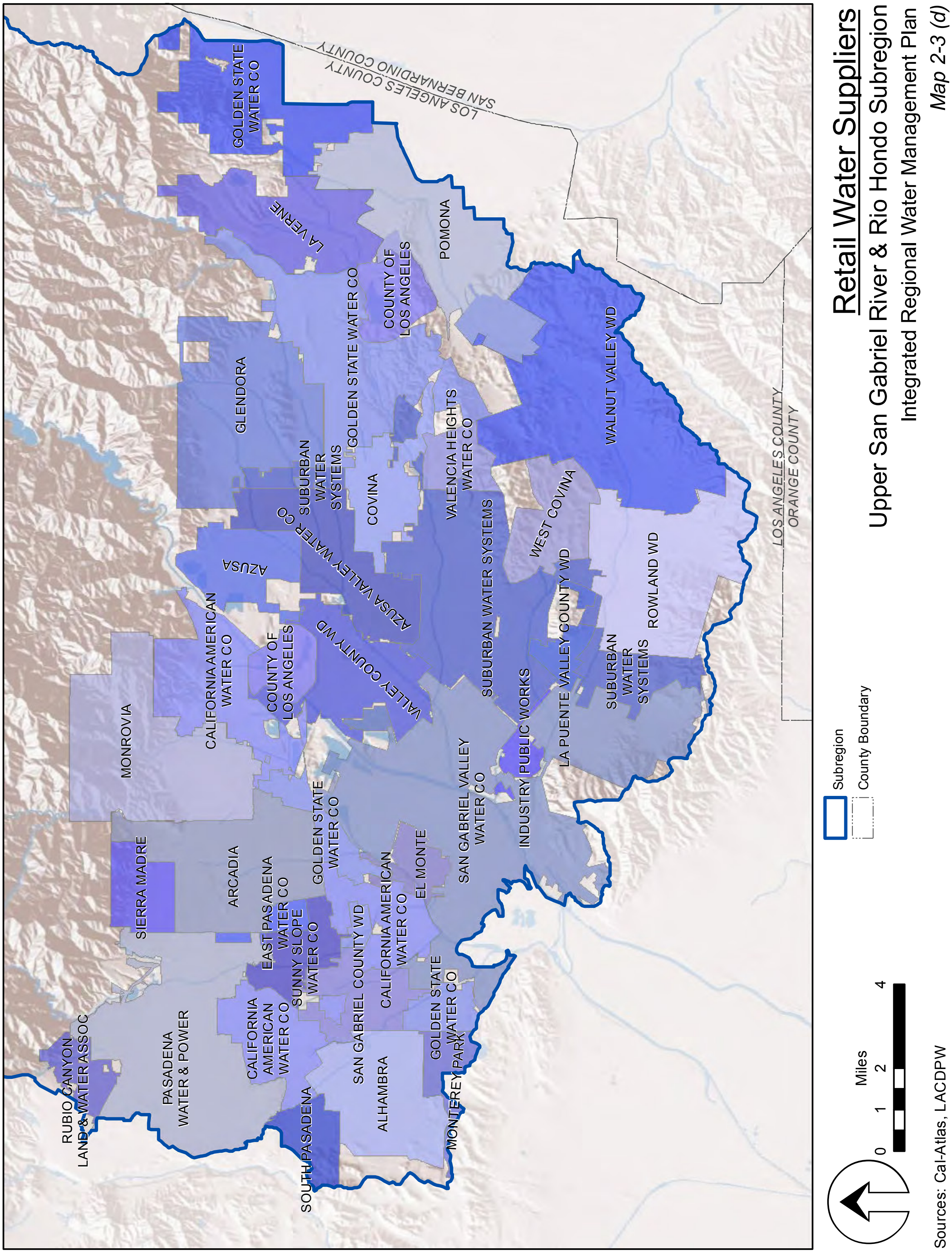
Sources: Cal-Atlas, LACDPW

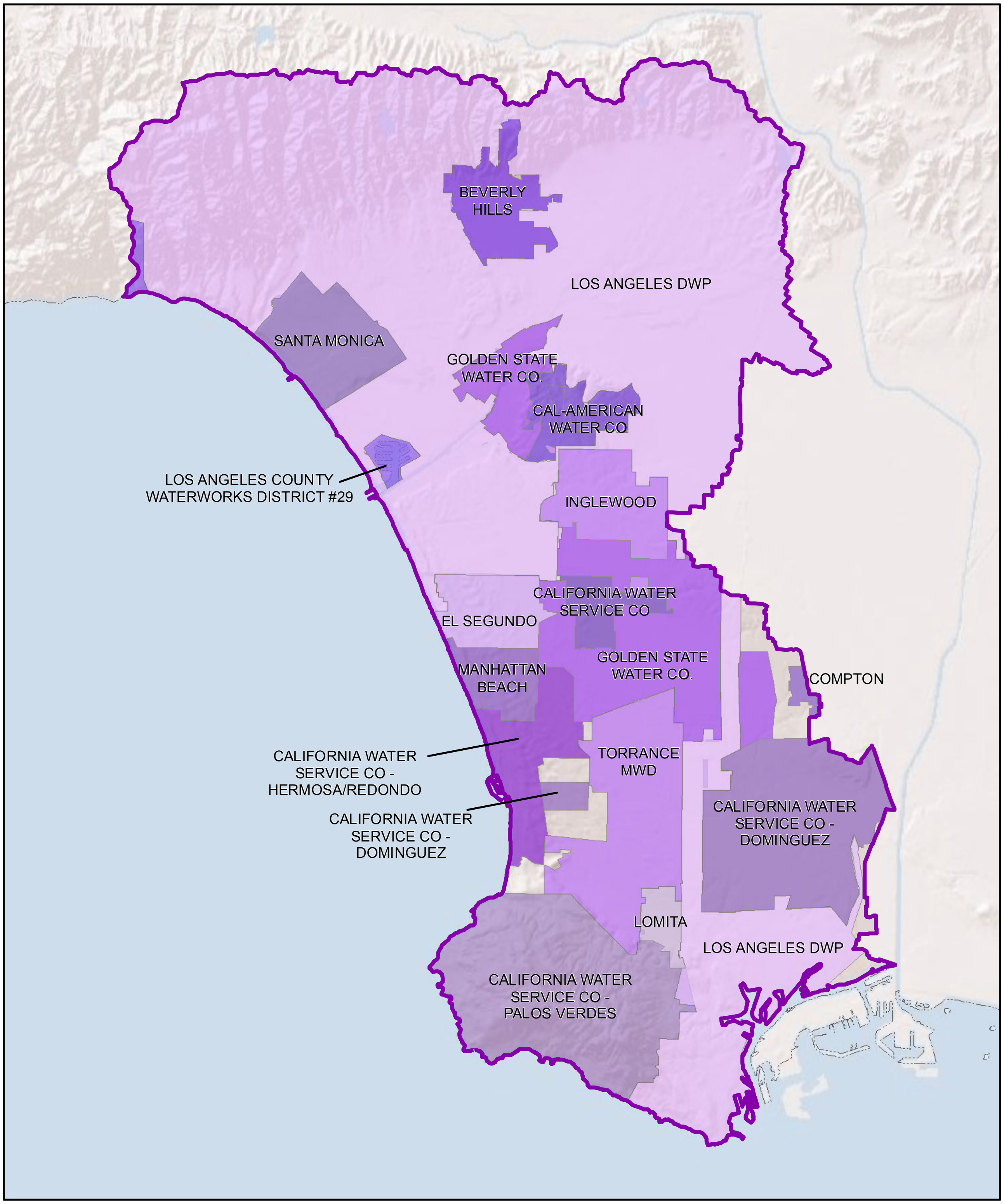
Retail Water Suppliers

Upper Los Angeles River Subregion

Integrated Regional Water Management Plan

Map 2-3 (c)


Retail Water Suppliers
Upper San Gabriel River & Rio Hondo Subregion
Integrated Regional Water Management Plan
Map 2-3 (d)
Subregion
County Boundary
Miles
0 1 2 4
Sources: Cal-Atlas, LACDPW
SAN BERNARDINO COUNTY
LOS ANGELES COUNTY
ORANGE COUNTY
GOLDEN STATE WATER CO
LA VERNE
POMONA
COUNTY OF LOS ANGELES
GLENDORA
WALNUT VALLEY WD
VALENCIA HEIGHTS WATER CO
COVINA
SUBURBAN WATER SYSTEMS
WEST COVINA
ROWLAND WD
AZUSA
AZUSA VALLEY WATER CO
VALLEY COUNTY WD
LA PUENTE VALLEY COUNTY WD
INDUSTRY PUBLIC WORKS
SAN GABRIEL VALLEY WATER CO
CALIFORNIA AMERICAN WATER CO
MONROVIA
ARCADIA
SIERRA MADRE
EAST PASADENA WATER CO
SUNNY SLOPE WATER CO
EL MONTE
SAN GABRIEL COUNTY WD
PASADENA WATER & POWER
RUBIO CANYON LAND & WATER ASSOC
ALHAMBRA
MONTEREY PARK
SOUTH PASADENA



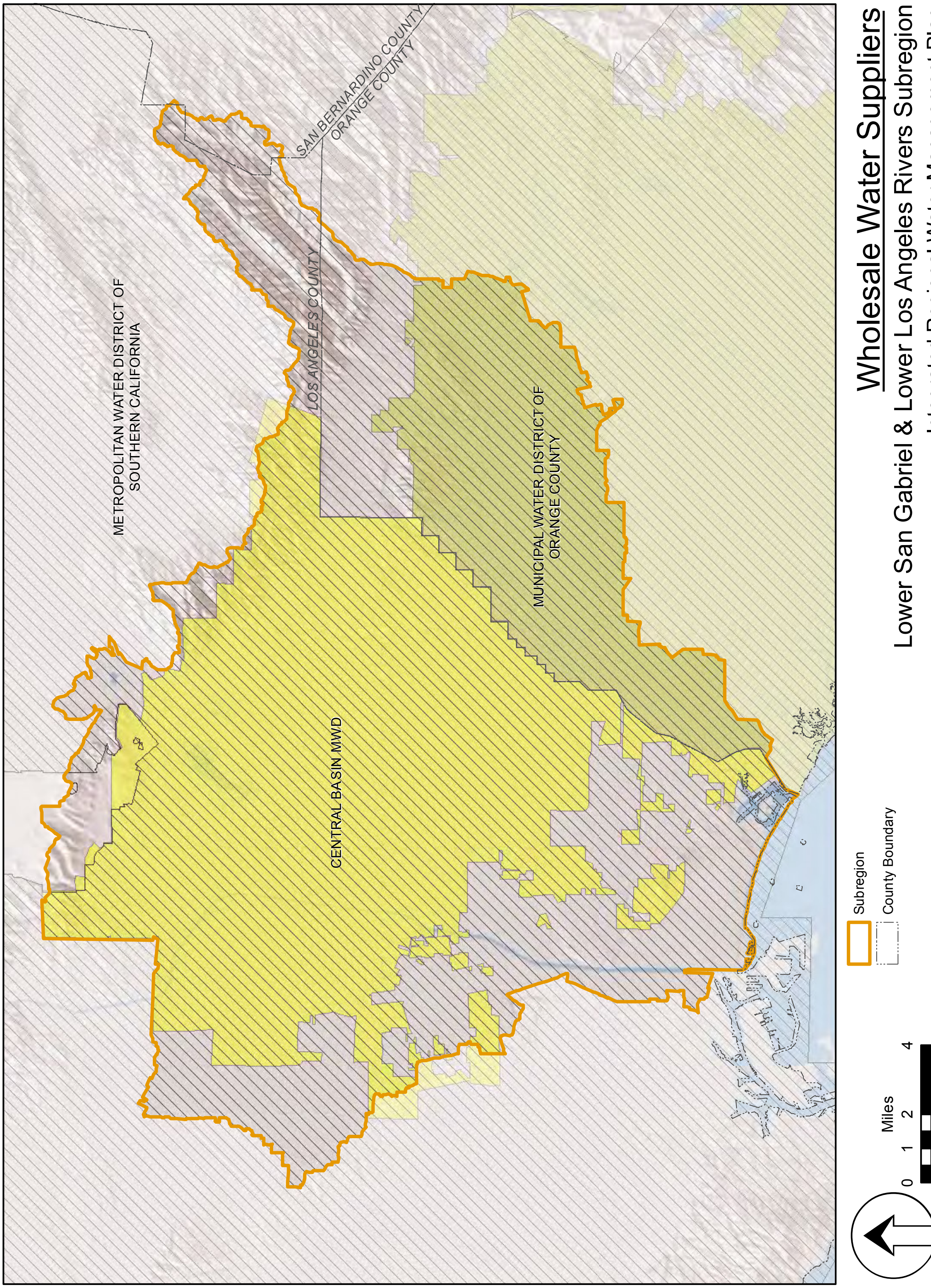
<u>Retail Water Suppliers</u>

South Bay Subregion

Integrated Regional Water Management Plan

Map 2-3 (e)

Sources: Cal-Atlas, LACDPW
West Basin MWD



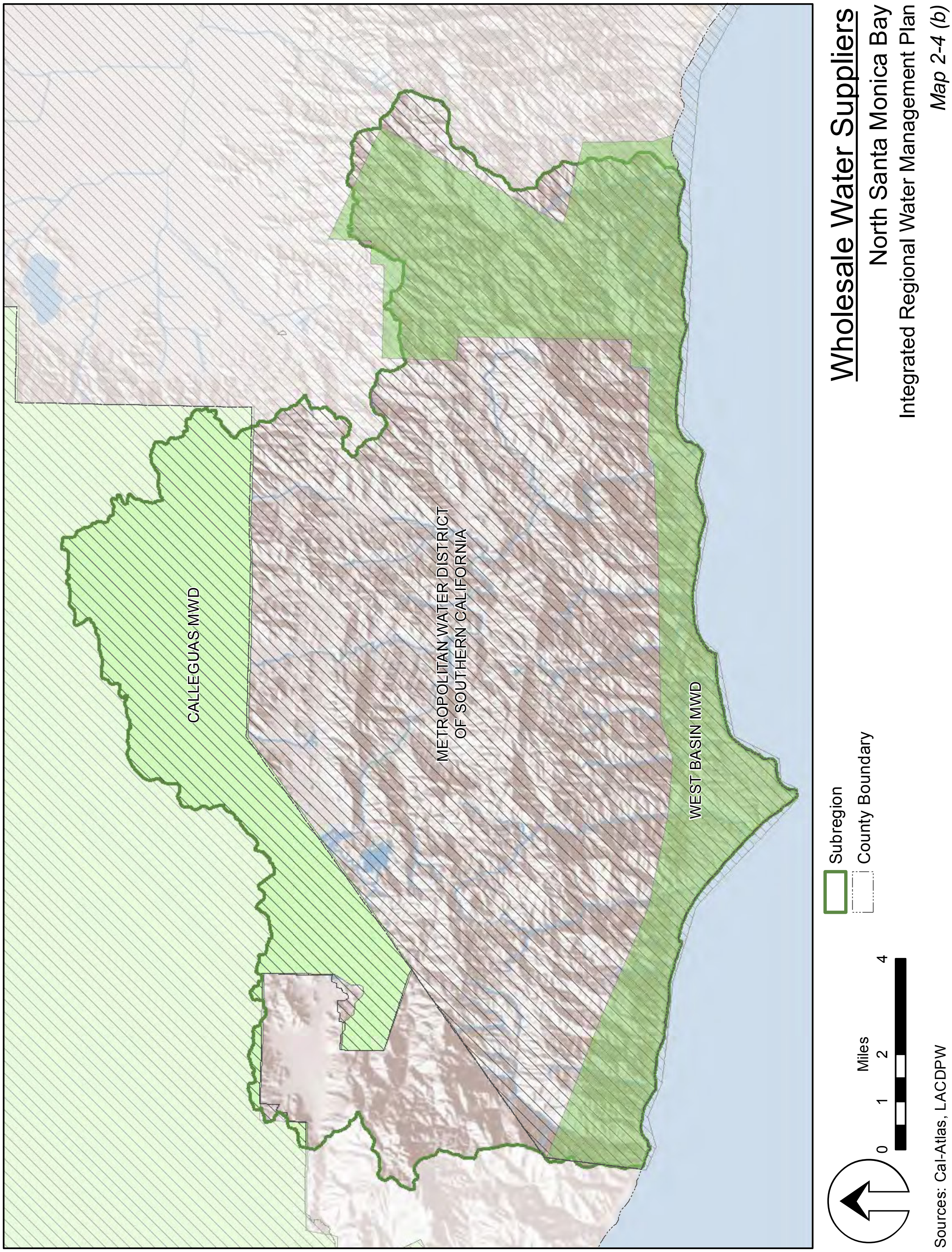
Sources: Cal-Atlas, LACDPW

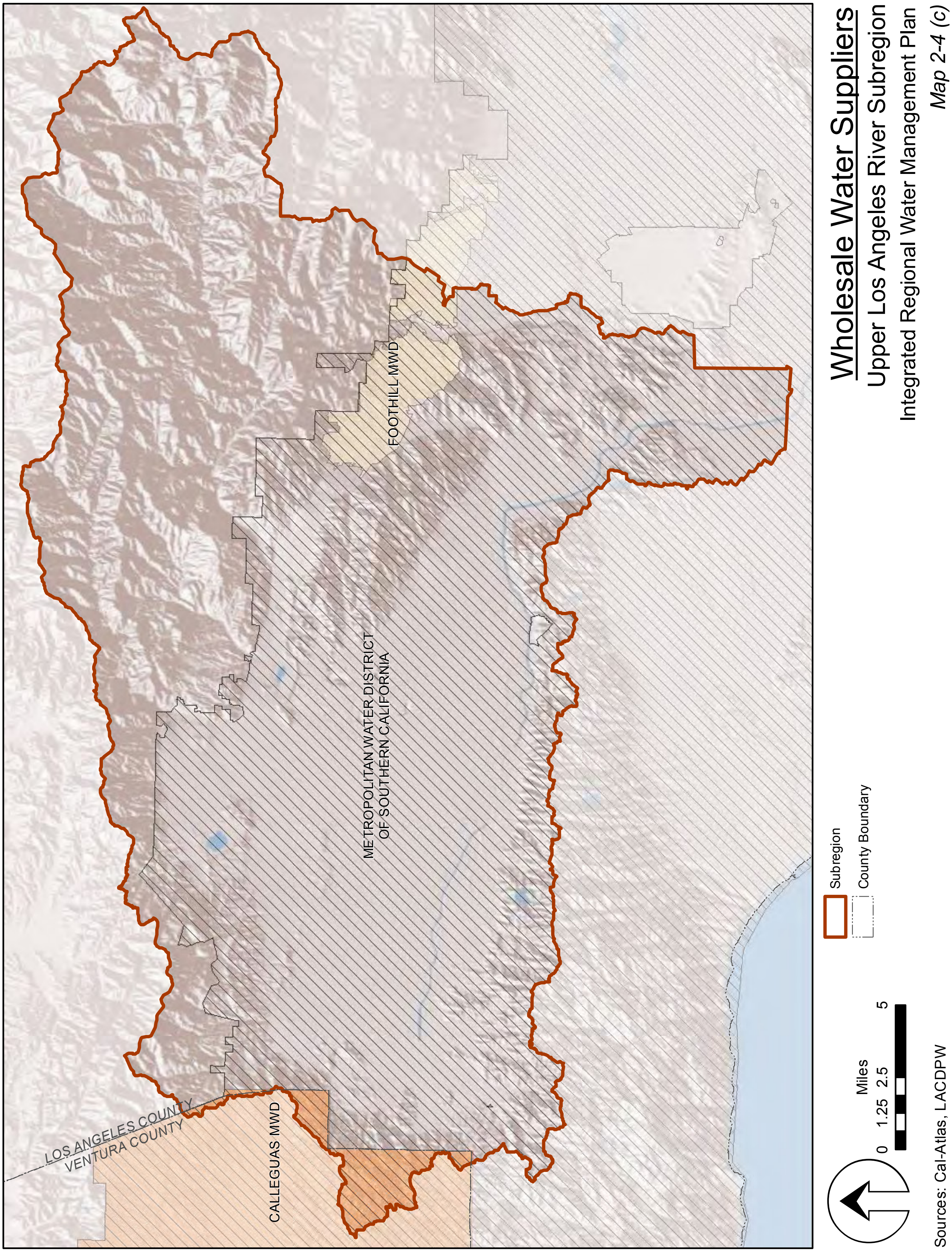
Wholesale Water Suppliers

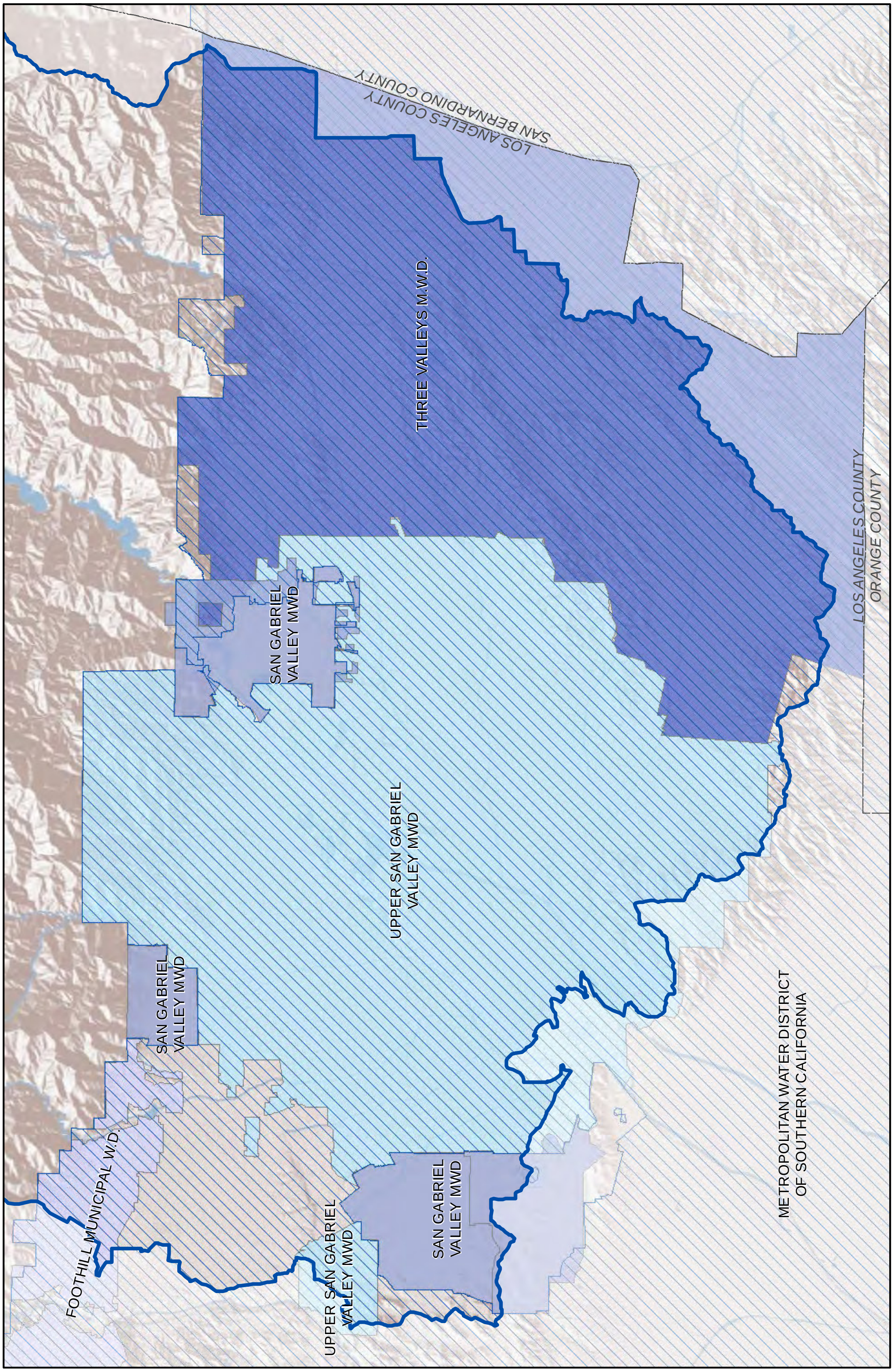
Lower San Gabriel & Lower Los Angeles Rivers Subregion

Integrated Regional Water Management Plan

Map 2-4 (a)


Wholesale Water Suppliers
North Santa Monica Bay
Integrated Regional Water Management Plan
Map 2-4 (b)
CALLEGUAS MWD
METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA
WEST BASIN MWD
Subregion
County Boundary
Miles
0 1 2 4
Sources: Cal-Atlas, LACDPW


Wholesale Water Suppliers
Upper Los Angeles River Subregion
Integrated Regional Water Management Plan
Map 2-4 (c)
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
FOOTHILL MWD
CALLEGUAS MWD
LOS ANGELES COUNTY
VENTURA COUNTY
Subregion
County Boundary
Miles
0 1.25 2.5 5
Sources: Cal-Atlas, LACDPW



Wholesale Water Suppliers

Upper San Gabriel River & Rio Hondo Subregion

Integrated Regional Water Management Plan

Map 2-4 (d)

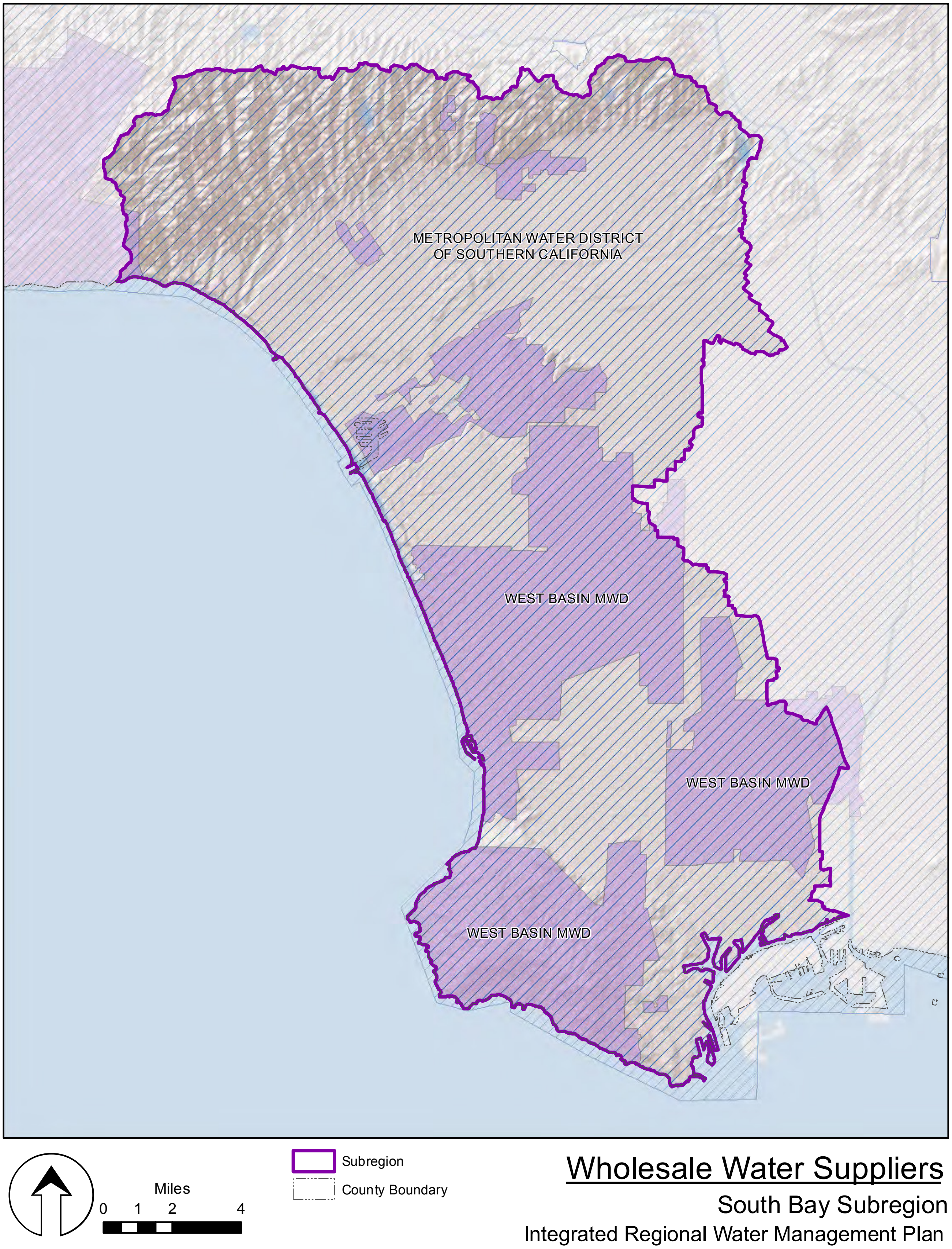
Subregion

County Boundary

Miles

0 1 2 4

Sources: Cal-Atlas, LACDPW



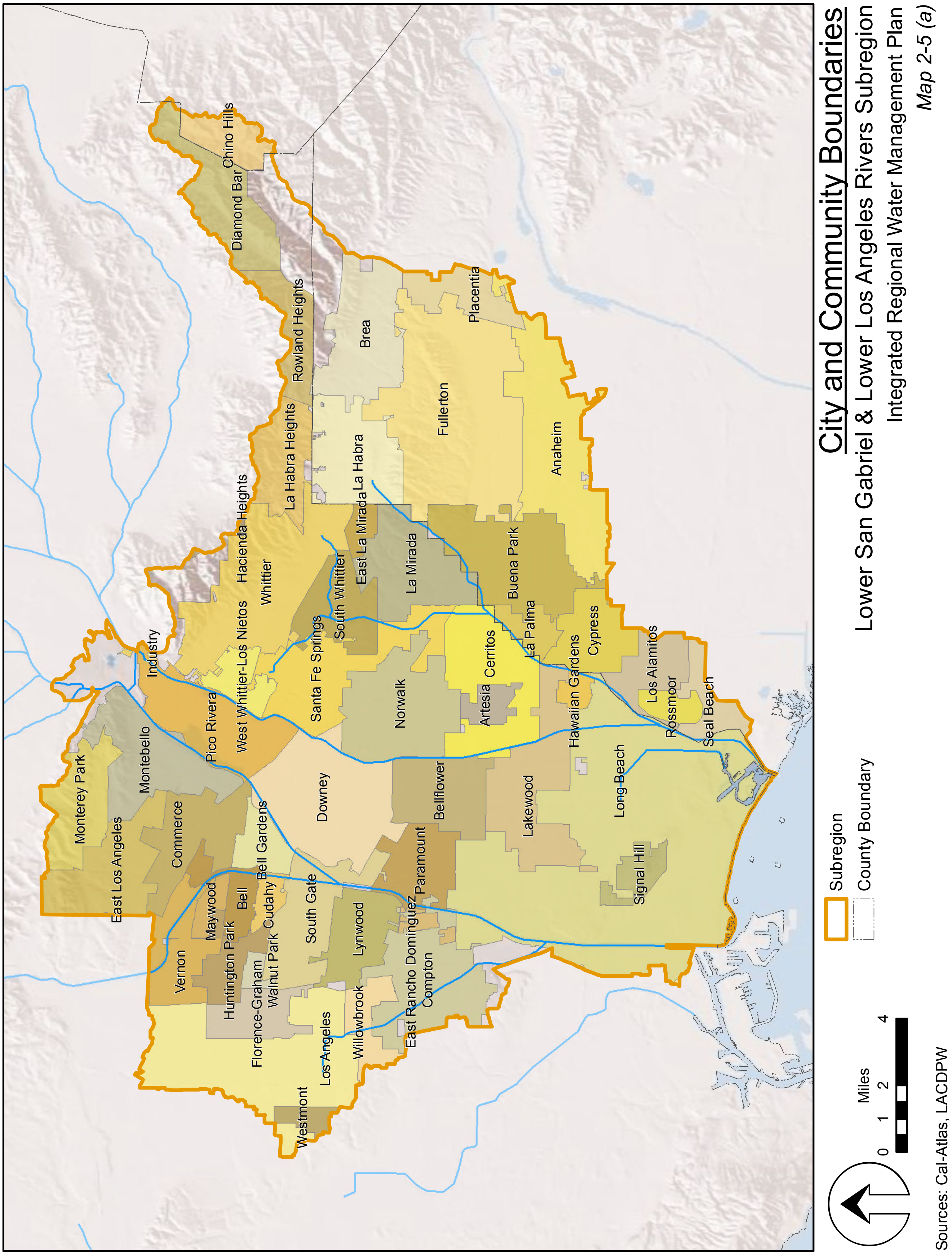
Sources: Cal-Atlas, LACDPW

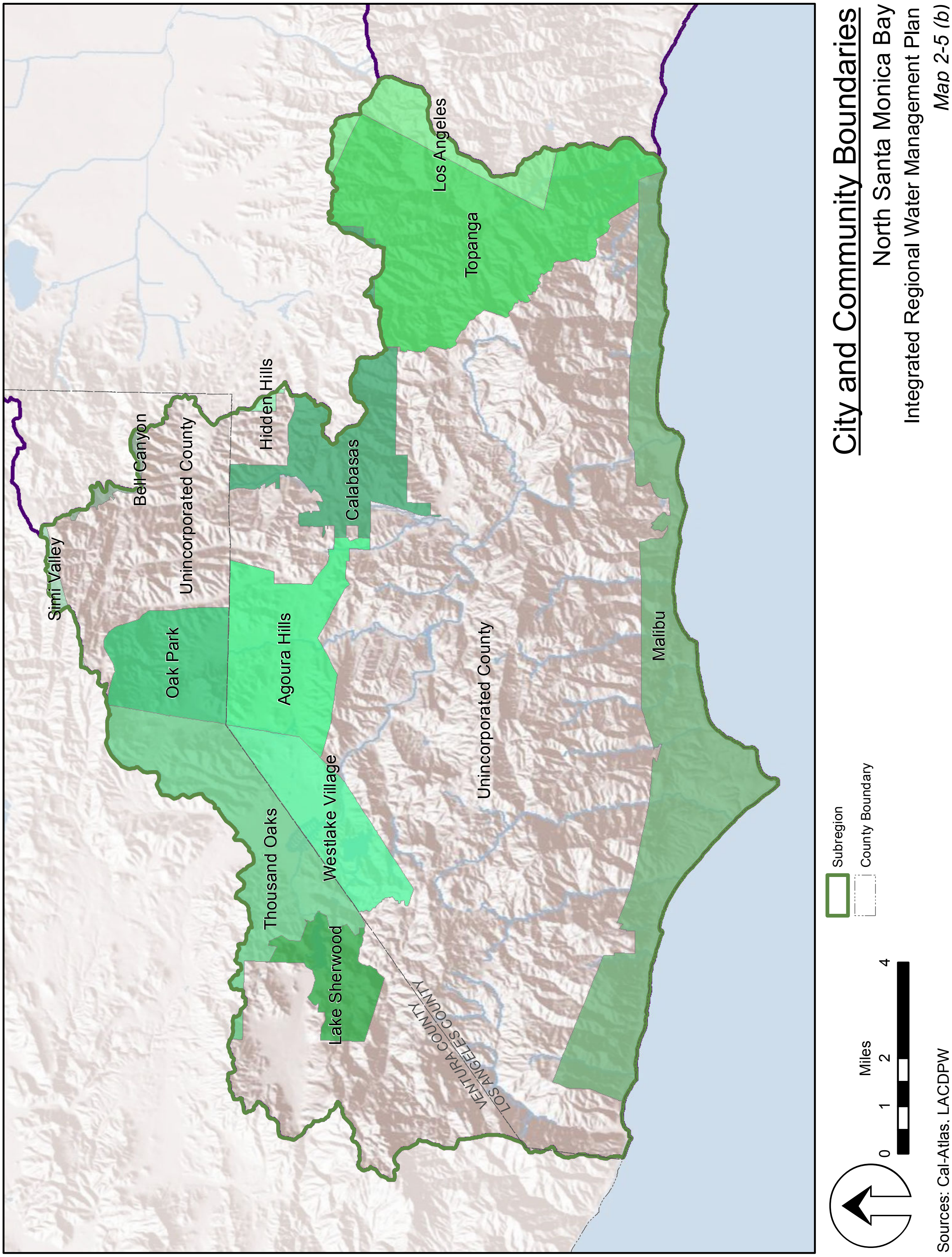
Wholesale Water Suppliers

South Bay Subregion

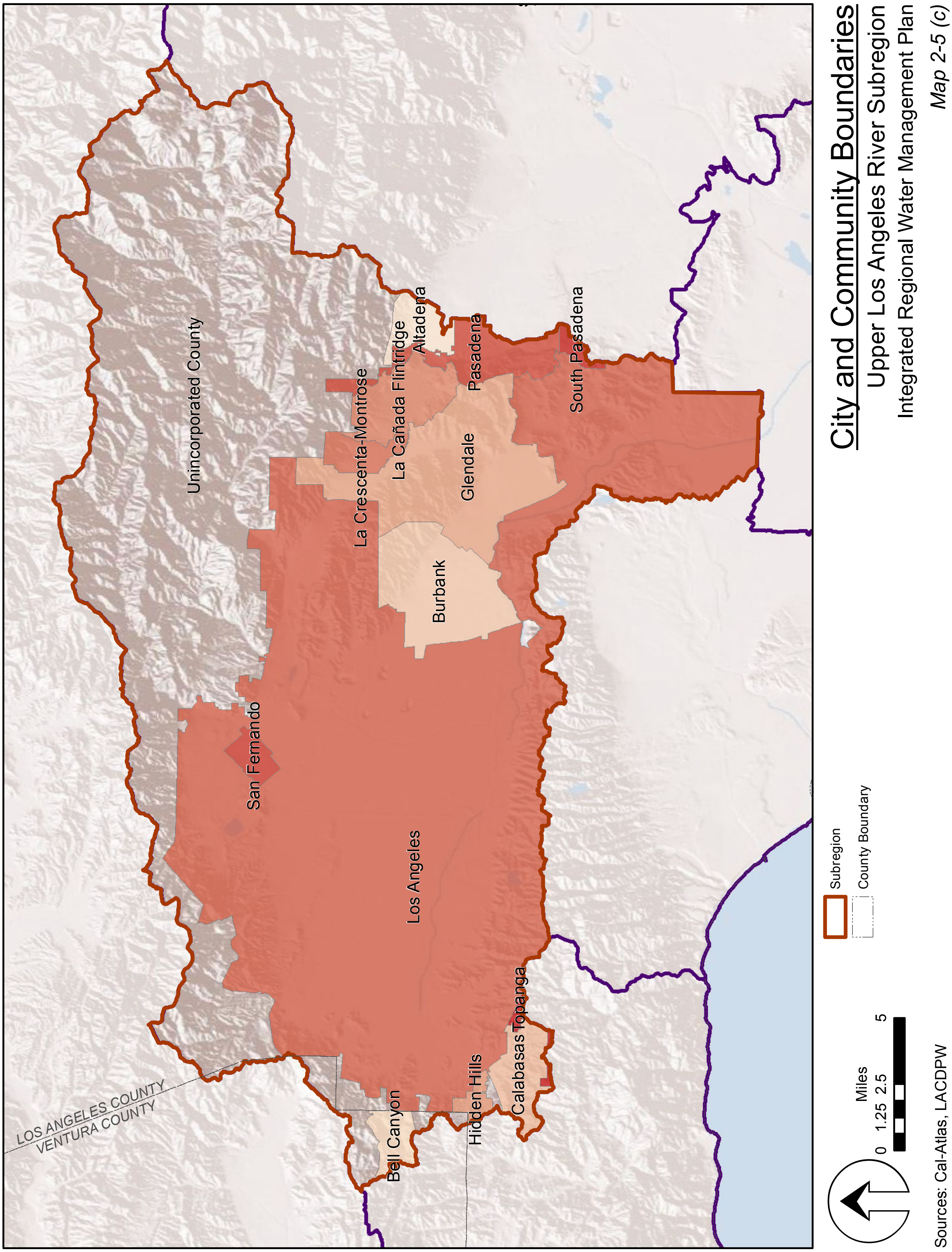
Integrated Regional Water Management Plan

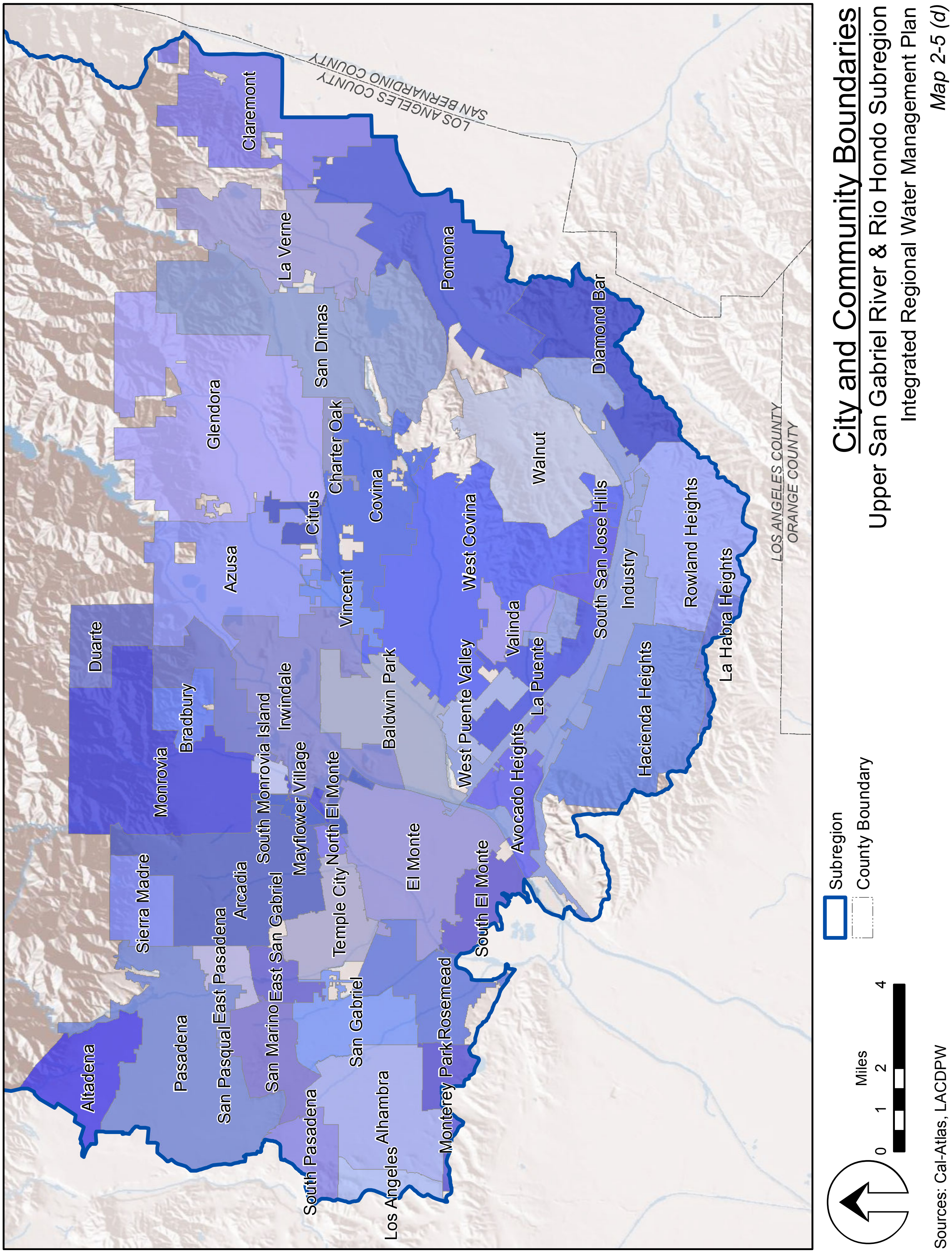
Map 2-4 (e)


City and Community Boundaries
Lower San Gabriel & Lower Los Angeles Rivers Subregion
Integrated Regional Water Management Plan
Map 2-5 (a)
Subregion
County Boundary
Miles
0 1 2 4
Sources: Cal-Atlas, LACDPW
Chino Hills
Diamond Bar
Rowland Heights
Brea
Placentia
Fullerton
La Habra Heights
La Habra
Anaheim
Hacienda Heights
Whittier
East La Mirada
La Mirada
Buena Park
Industry
West Whittier-Los Nietos
South Whittier
Santa Fe Springs
La Palma
Cypress
Cerritos
Los Alamitos
Rossmoor
Seal Beach
Hawaiian Gardens
Artesia
Norwalk
Pico Rivera
Montebello
Monterey Park
East Los Angeles
Commerce
Downey
Bellflower
Lakewood
Long Beach
Signal Hill
Bell Gardens
Bell
Cudahy
Maywood
Vernon
Huntington Park
Walnut Park
Florence-Graham
South Gate
Lynwood
Paramount
East Rancho Dominguez
Compton
Willowbrook
Los Angeles
Westmont

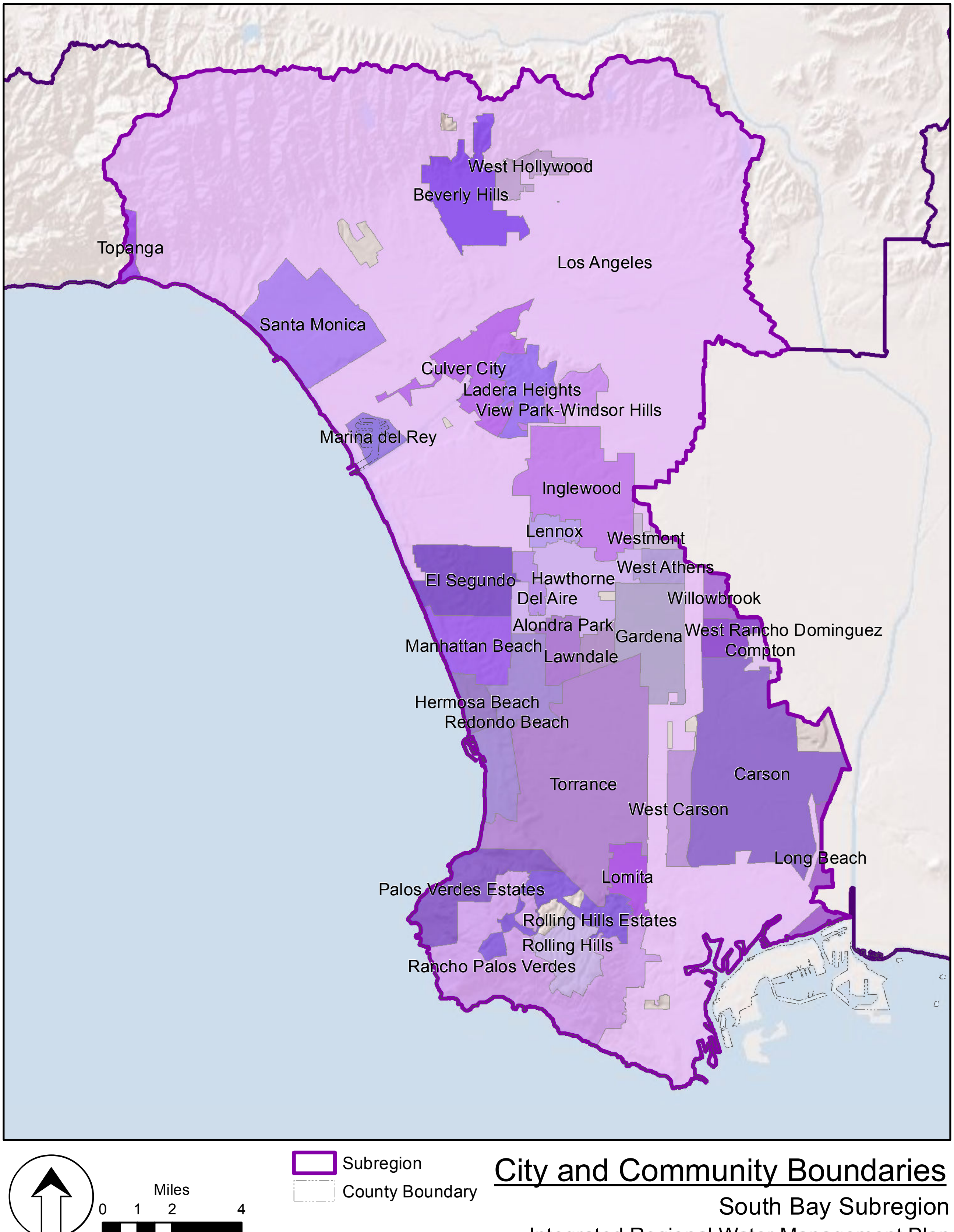


City and Community Boundaries
North Santa Monica Bay
Integrated Regional Water Management Plan
Map 2-5 (b)


City and Community Boundaries
Upper Los Angeles River Subregion
Integrated Regional Water Management Plan
Map 2-5 (c)
Subregion
County Boundary
Miles
0 1.25 2.5 5
Sources: Cal-Atlas, LACDPW
LOS ANGELES COUNTY
VENTURA COUNTY
Unincorporated County
Altadena
La Cañada Flintridge
La Crescenta-Montrose
Pasadena
South Pasadena
Glendale
Burbank
San Fernando
Los Angeles
Topanga
Calabasas
Hidden Hills
Bell Canyon



City and Community Boundaries
Upper San Gabriel River & Rio Hondo Subregion
Integrated Regional Water Management Plan
Map 2-5 (d)



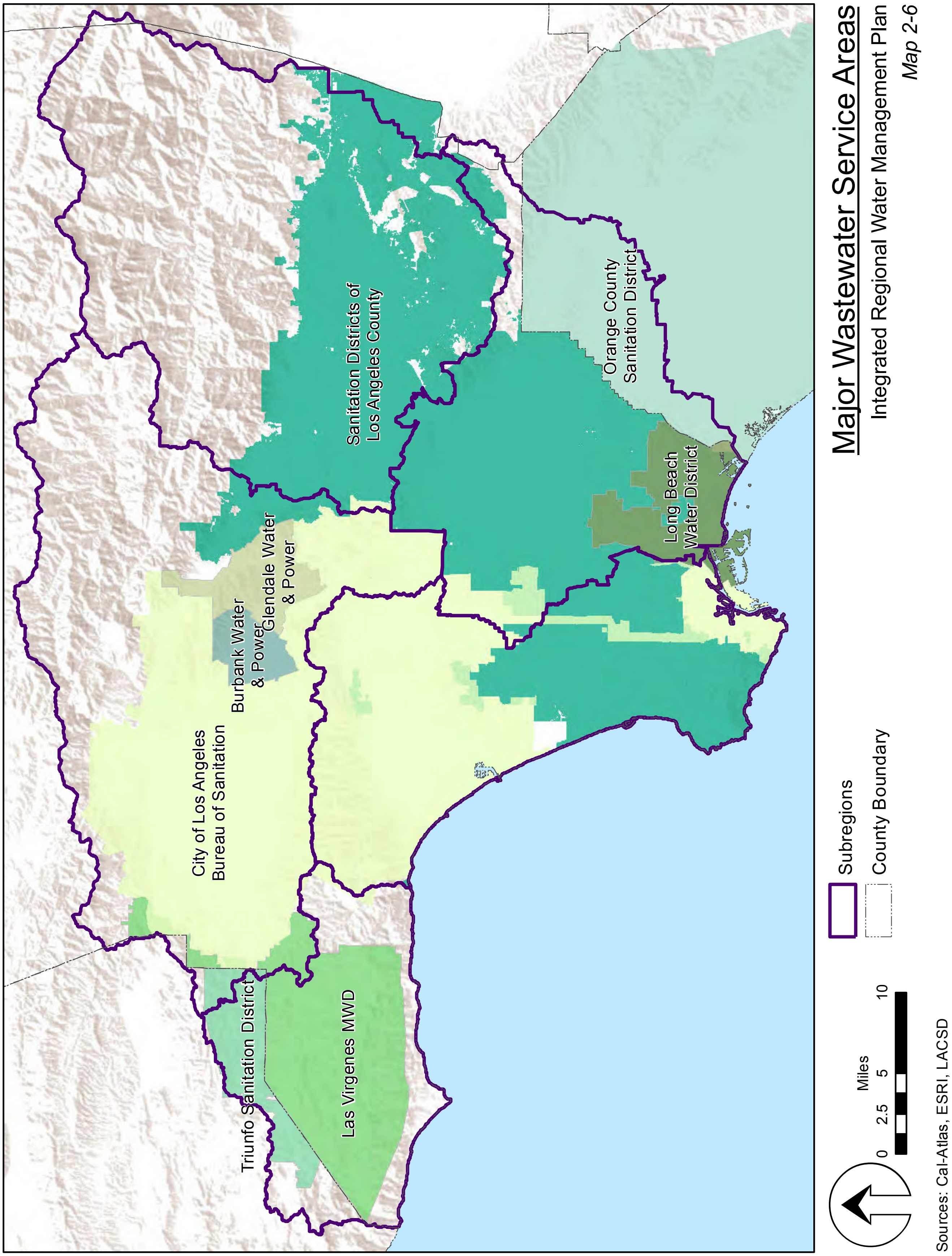
City and Community Boundaries

South Bay Subregion

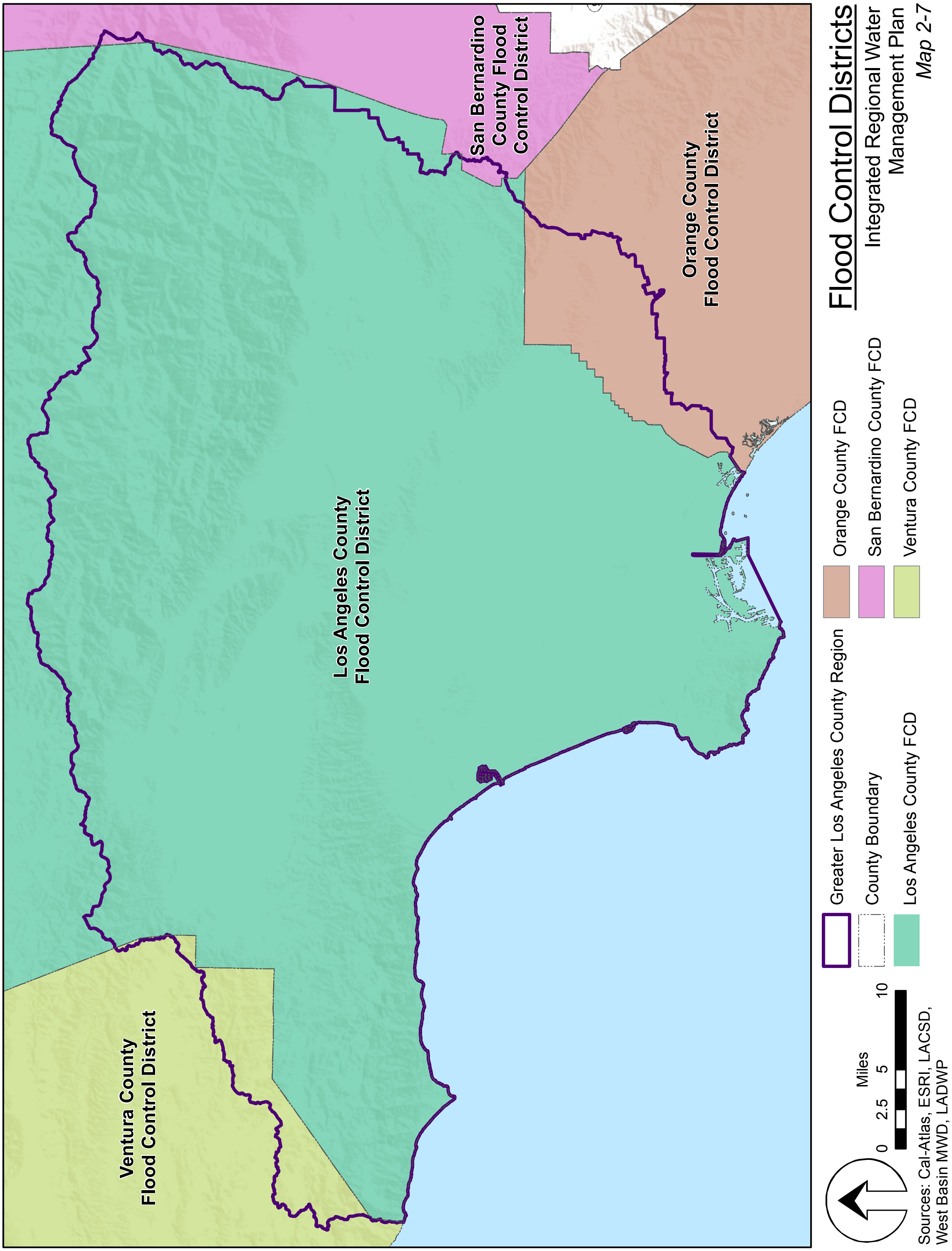
Integrated Regional Water Management Plan

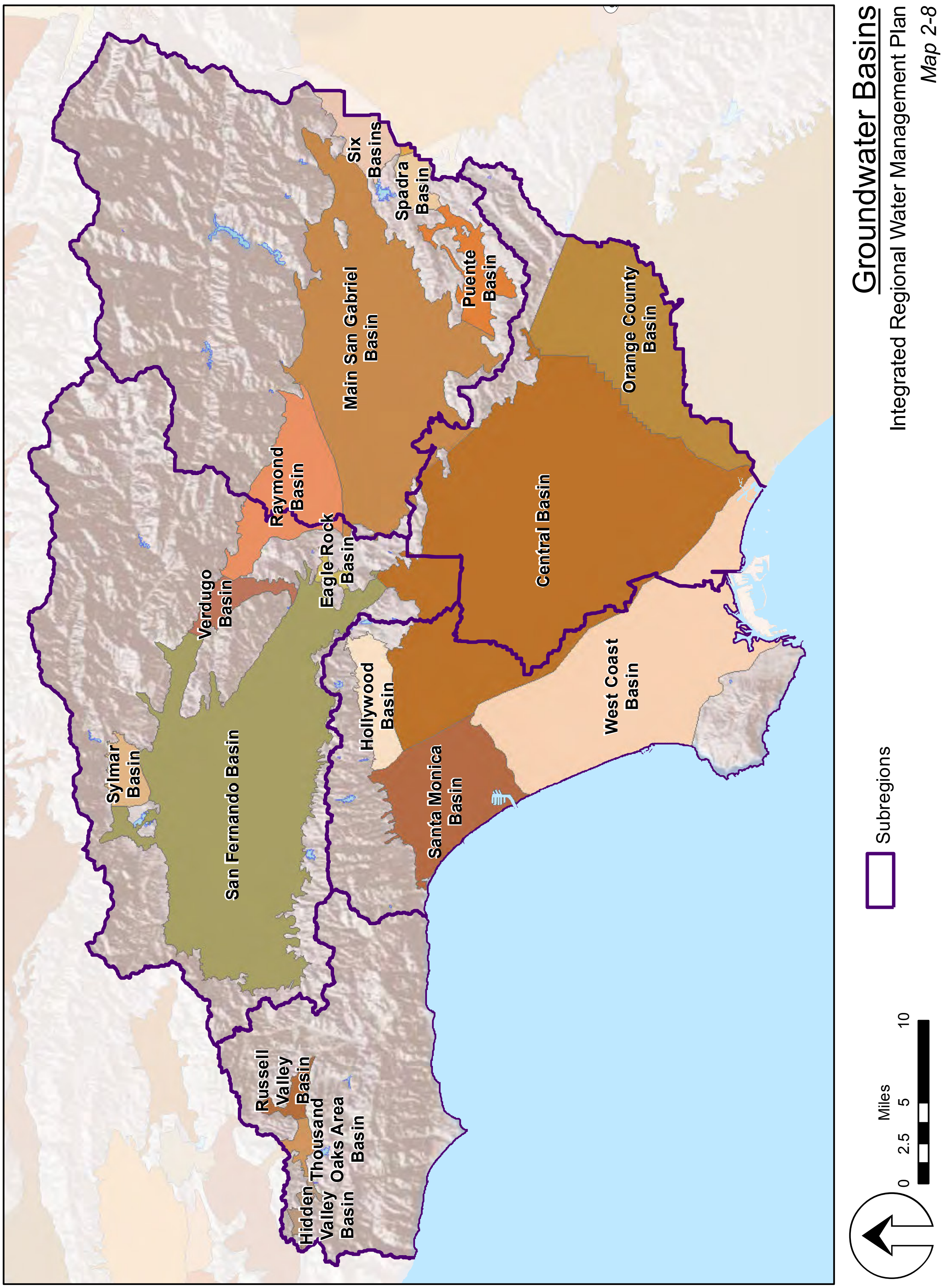
Map 2-5 (e)

Sources: Cal-Atlas, LACDPW



Major Wastewater Service Areas
Integrated Regional Water Management Plan
Map 2-6


Flood Control Districts
Integrated Regional Water Management Plan
Map 2-7
Los Angeles County Flood Control District
San Bernardino County Flood Control District
Orange County Flood Control District
Ventura County Flood Control District
Greater Los Angeles County Region
County Boundary
Los Angeles County FCD
Orange County FCD
San Bernardino County FCD
Ventura County FCD
Miles
0 2.5 5 10
Sources: Cal-Atlas, ESRI, LACSD, West Basin MWD, LADWP


Groundwater Basins
Integrated Regional Water Management Plan
Map 2-8
Subregions
Miles
0
2.5
5
10
Six Basins
Spadra Basin
Puente Basin
Main San Gabriel Basin
Orange County Basin
Raymond Basin
Central Basin
Eagle Rock Basin
Verdugo Basin
West Coast Basin
Hollywood Basin
Sylmar Basin
San Fernando Basin
Santa Monica Basin
Russell Valley Basin
Thousand Oaks Area Basin
Hidden Valley Basin

2.5 Sources of Water Supply and Infrastructure

The Region has developed a diverse mix of local and imported water supply sources and its associated infrastructure. Local water resources include groundwater, local surface water, recycled water, stormwater capture and use, water transfers, storage, and water use efficiency. Water is imported through the California State Water Project (SWP), the Colorado River Aqueduct, and the Los Angeles Aqueducts. Major water supply sources are described below.

Groundwater

Groundwater represents a significant portion of local supplies in the Region, approximately 35 percent of the Region's entire supply in 2010. Most groundwater basins in the Region are adjudicated (via a court decision) and producers within these basins follow management guidelines established by their respective adjudications. Exceptions are the Orange County Basin, Santa Monica Basin, Hollywood Basin, and Puente Basin. The City of Santa Monica has implemented a groundwater management plan for the Santa Monica Basin. The Orange County Basin (which extends outside the southern boundary of the Region) is managed by Orange County Water District, which was established in 1933.

Groundwater basin recharge can occur via existing and restored natural channel bottoms or percolation of rainwater (natural recharge), however natural recharge is typically insufficient to maintain basin water levels and current pumping levels due to the extent of impervious surfaces and the presence of clay soils in parts of the Region. Many agencies rely on artificial recharge, by diverting local supplies from rivers or creeks when flow conditions are optimal, to spreading grounds (or basins) which typically contain sandy soils that promote infiltration. In some locations, spreading is limited because of the capacity limitations of the spreading facilities rather than being limited by water supply. Historical concerns about the presence of urban contaminants in stormwater may also limit the amount of local water that can be recharged, although the Water Augmentation Study conducted by the Council for Watershed Health monitored several sites and determined that stormwater pollutants do not degrade groundwater quality. In addition, recycled water is infiltrated in spreading grounds and injected (along with imported water) along the coast to form barriers to seawater intrusion at three locations (the Alamitos, Dominguez Gap, and West Coast Basin Barriers). This water augments and blends with groundwater, which is eventually extracted for potable use.

Conjunctive use programs may also be implemented to recharge basins, where imported water is recharged via spreading grounds or injection wells. Recharge can also occur "in-lieu," when an agency suspends production from its wells and uses other supplies. The reduction in pumping permits groundwater levels in the basin to recover. The amount of water that can be recharged in the basin may be limited by local runoff, recharge capacity, overlying groundwater demands, and water rights. Most of the time, it is more cost effective for agencies to supply groundwater rather than purchase imported water. Thus, the strategy of most groundwater agencies is to maximize groundwater production, up to estimated annual yield limits without significantly impacting groundwater levels, and meet the balance of the customer demand through imported or local water.

Groundwater basin water quality is a significant issue in the Region, as natural conditions result in high dissolved salt levels. In some aquifers, salt levels are so high the water is termed "brackish," which either requires desalination or advanced treatment to make the supply usable or blending the treated water with other supplies that have a lower salt content. In addition, land use practices and production practices have deteriorated water quality in portions of certain groundwater basins.

Many factors have contributed to the deterioration of water quality including historic overdrafting of groundwater basins (sometimes resulting in seawater intrusion), industrial discharges, agricultural chemical usage, livestock operations, contaminants in urban runoff, and naturally occurring constituents. The cost of treating these contaminants is often significant, and for some improperly disposed chemicals, effective treatment has not yet been identified.

Various agencies, including the San Gabriel Basin Water Quality Authority and the WRD have implemented programs to assess treatment options and treat the contaminated groundwater.

Local Surface Water

Los Angeles River

The Los Angeles River flows 51 miles from the union of Bell Creek and Arroyo Calabasas in the San Fernando Valley, then southeast through the City of Burbank and eventually southward to Long Beach. Originally, the Los Angeles River was the primary water source for the City of Los Angeles. Following several catastrophic floods, the Army Corps encased most of the river bed and banks in concrete, effectively eliminating interaction between groundwater and surface water in certain areas. Today, the river is primarily fed from stormwater, effluent from wastewater treatment plants, urban runoff, base flow from the Santa Monica and San Gabriel Mountains, and groundwater inflow in the Glendale Narrows.

Water agencies that have water diversion rights within the Los Angeles River watershed include the City of Pasadena and the City of Los Angeles. The City of Pasadena has rights up to 25 cubic feet per second (cfs) of Arroyo Seco runoff, though the yield of the Arroyo Seco is highly variable depending on weather and rain patterns, and uses its diversions for both direct use and groundwater recharge. Pasadena uses its rights for recharge of the local groundwater basin and treats for direct use. The City of Los Angeles has full rights to flows in the Los Angeles River and uses its diversion rights for groundwater recharge at various locations in the San Fernando Valley.

San Gabriel River

The San Gabriel River flows 75 miles southwest from the San Gabriel Mountains, then southward from the Whittier Narrows to its ocean discharge at the City of Seal Beach. Unlike the Los Angeles River, due to more favorable soil conditions the San Gabriel River has a natural bed for most of its length, although the banks are armored with rip rap and concrete for flood control purposes. The river is fed by stormwater, base flow from the San Gabriel Mountains, dry weather urban runoff and effluent from wastewater treatment plants.

The San Gabriel River has been fully appropriated by the State Water Resources Control Board, with surface water rights belonging to two entities: the San Gabriel River Water Committee and the San Gabriel Valley Protective Association, which then distribute the water for either direct use or for groundwater recharge. Significant quantities of surface water naturally recharge groundwater via the permeable bottom in the San Gabriel River and are also used for groundwater recharge in several locations. During the dry season, the presence of dams and other diversions results in river flow that is sometimes discontinuous, as some river reaches are dry, while other reaches have flow.

Imported Water

State Water Project

The SWP is a system of reservoirs, pumps and aqueducts that carries water from Lake Oroville and other facilities north of Sacramento to the Sacramento-San Joaquin Delta and then transports that water to central and southern California. Environmental concerns in the Sacramento-San Joaquin Delta have limited the volume of water that can be pumped from the SWP. The potential impact of further declines in ecological indicators in the Bay-Delta system on SWP water deliveries is unclear. Uncertainty about the long-term stability of the levee system surrounding the Delta system raises concerns about the ability to transfer water via the Bay-Delta to the SWP.

The MWD contract with the DWR, operator of the SWP, is for 1,911,500 AFY. However, MWD projects a minimum dry year supply from the SWP of 370,000 AFY, and average annual deliveries of 1.4 million AFY. These amounts do not include water which may become available from transfer and storage programs, or Delta improvements. The San Gabriel Valley MWD's contract with DWR is for 28,800 AFY. San Gabriel Valley MWD uses this water to replenish the Main San Gabriel Basin as needed by its member agencies and the Main San Gabriel Basin Watermaster and is generally able to balance demands during dry years with water stored in the groundwater basin.

The infrastructure built for the project has become an important water management tool for moving not only annual deliveries from the SWP but also transfer water from other entities. MWD, among others, has agreements in place to store water at a number of groundwater basins along the aqueduct, primarily in Kern County. When needed, the project facilities can be used to move stored water to southern California. However, there are certain obstacles that must be overcome, including substantive limitations on the movement of water across the Bay-Delta system, court ordered pumping restrictions, constraints related to the quality of water, and the cost of the water. Generally speaking, DWR will not allow water in their aqueduct that is of lower quality than its own water.

Colorado River

California water agencies are entitled to 4.4 million AFY of Colorado River water. Of this amount, the first three priorities totaling 3.85 million AFY are assigned in aggregate to the agricultural agencies along the river. MWD's fourth priority entitlement is 550,000 AFY. Until recently, MWD routinely had access to 1.2 million AFY because Arizona and Nevada had not been using their full entitlement and the Colorado River flow was often adequate enough to yield surplus water to MWD.

Possible future drought year reductions in water supply from the Colorado River highlight the need for less dependence on imported water in the Region.

MWD delivers the available water via the 242-mile Colorado River Aqueduct, completed in 1941, which has a capacity of 1.2 million AFY.

The Quantification Settlement Agreement (QSA), executed in 2003, affirms the state's right to 4.4 million AFY, though water allotments to California from the Colorado River could be reduced during future droughts along the Colorado River watershed as other states increase their diversions in accord with their authorized entitlements. California's Colorado River Water Use Plan and the QSA provide the numeric baseline to measure conservation (such as the lining of existing earthen canals) and water transfer programs (such as shifts from water from agricultural use to urban use). Such transfers between willing sellers and willing buyers would offset potential reductions in future deliveries of urban water made available by the Colorado River.

The QSA and several other related agreements were executed in October 2003, provide the numeric baseline to measure conservation and transfer programs by which unused agricultural priority water would be made available for diversion by MWD. They also allow for implementation of agricultural conservation, land management, canal lining and other programs. Since the signing of the QSA, water conservation measures have been implemented including the agriculture-to-urban transfer of conserved water from Imperial Valley to San Diego, agricultural land fallowing with Palo Verde, and the lining of the All-American Canal. By 2020, the QSA programs are expected to allow delivery to full capacity of the Colorado River Aqueduct at 1.25 million AFY, if needed.

Los Angeles Aqueducts

High-quality water from the Mono Basin and Owens Valley is delivered through the Los Angeles Aqueducts to the City of Los Angeles. Construction of the original 233-mile Los Angeles Aqueduct from the Owens Valley was completed in 1913. In 1940 the aqueduct was extended 105 miles north to Mono Basin. A second aqueduct from Owens Valley was completed in 1970 to further increase capacity. Approximately 480,000 AFY of water can be delivered to the City of Los Angeles each year; however the amount the aqueducts deliver varies from year to year due to fluctuating precipitation in the Sierra Nevada Mountains and mandatory in-stream flow requirements. In addition, the diversion of water from Mono Lake has been reduced following a decision of the SWRCB and exportation of water from the Owens Valley is limited by the Inyo-Los Angeles Long Term Water Agreement (and related MOU) and an additional MOU between the Great Basin Air Pollution Control District and the City of Los Angeles (to reduce particulate matter air pollution from the Owens Lake bed). Additionally, water quality concerns such as disinfection byproducts may require future treatment of Los Angeles Aqueduct water. As a result of these restrictions on water transfers, future deliveries are expected to be reduced to an average of 254,000 AFY over the next 20 years.

Recycled Water

Current average annual recycled water production in the Region is approximately 232,000 AFY, which represents approximately 20 percent of the current average annual effluent flows. Of the 232,000 AFY of recycled water produced, approximately 125,000 AFY is currently reused for urban landscape and agricultural irrigation, industrial process applications, environmental uses, groundwater replenishment, for maintenance of seawater barriers in groundwater basins along the coast. The remainder is currently discharged to creeks and rivers, often in concrete-lined channels but supporting riparian habitat in some locations with soft bottoms, or directly to the ocean. The Region's recycled water systems are owned and operated by numerous agencies. The primary producers/suppliers of recycled water include the Sanitation Districts of Los Angeles County, West Basin MWD, Las Virgenes MWD/Triunfo Sanitation District JPA, and the City of Los Angeles. Supplies are conveyed to the local wholesale, retail water purveyors or in certain cases directly to customers for delivery to the end users located in their respective service areas.

Stormwater Capture and Use

The capture and use of stormwater runoff (runoff from urban areas that has not yet reached streams and rivers) is a potential source of supply that is currently underutilized. A majority of stormwater runoff from urban areas is currently directed to storm drains and is ultimately channeled into the ocean. Solutions such as rain barrels and cisterns would allow for the collection of stormwater for either direct use or infiltration. Water purveyors in the Region do not currently capture stormwater for direct use, but according to 2010 Urban Water Management Plans, expect to implement projects to equal 25,000 AFY. According to 2010 Urban Water Management Plans, the water purveyors in the Region plan on increasing stormwater recharge from 190,000 AFY to 215,000 AFY by the year 2035.

Water Transfers

Prior to 1991, water transfers within the Region had been limited to transfers of annual groundwater basin rights (which continue to occur). In addition, agencies sometimes transferred water to enhance operational flexibility. MWD's facilities generally have not been used to transfer local water from one agency to another mainly because of water quality issues and potential downstream impacts. Sometimes, there is a restriction to export groundwater outside basin boundaries as a result of adjudication of the basin.

In response to the 1991 drought, the Governor's Water Bank was developed. MWD and other SWP contractors took advantage of the program to augment supplies and lessen the severity of drought impacts. Since that time, MWD has participated in water transfers as a water management strategy to augment supplies. The City of Los Angeles plans to develop water transfers as part of its supply strategy to replace a portion of the City's Los Angeles Aqueduct water that has been dedicated for environmental enhancement uses in the Eastern Sierra Nevada. The City of Los Angeles plans on up to 40,000 AFY of transfers through a future interconnection between the Los Angeles Aqueduct and the California Aqueduct. Should the costs of purchasing and wheeling (or moving) water from outside the Region be lower than purchasing MWD water, other agencies would likely be interested in implementing water transfers as a supply strategy.

Storage

The water supply in the Region is heavily dependent on imported surface water; therefore various surface reservoirs (managed by MWD and the SWP) located outside the Region (such as Diamond Valley Lake) are used to facilitate water delivery to local water agencies and districts. Several smaller reservoirs have also been developed within the Region to assist in the management of water supplies. However, most of these local reservoirs are limited in their ability to capture local runoff. Most of the remaining dams in the Region have been developed for flood management purposes and are typically not used for long-term (e.g., multi-year) surface water storage.

The Army Corps oversees Hansen, Lopez and Sepulveda dams in the Los Angeles River watershed and Santa Fe and Whittier Narrows Dams in the San Gabriel River watershed. They are operated based on various constraints and operational priorities including flood protection, recreation, habitat preservation, and water conservation. Enhanced storage behind dams and better coordination between the Army Corps and local flood management entities regarding the timing of release of waters is a topic of discussion.

LACFCD oversees several surface water storage facilities, which were created to improve flood protection and store runoff for subsequent release and diversion to several spreading grounds for groundwater recharge. Additional spreading grounds are owned and operated by non-LACFCD entities in the Region.

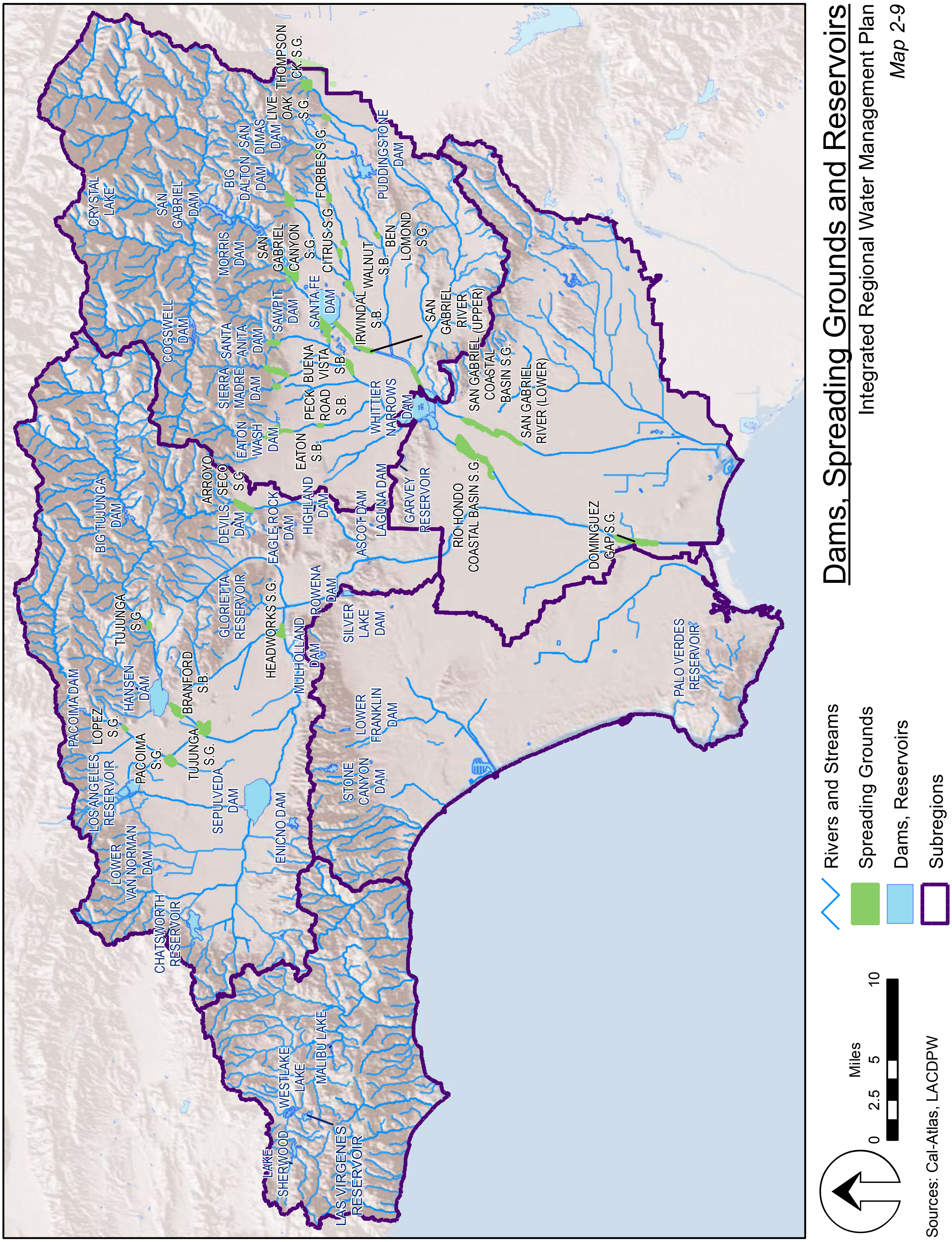
Eleven dams were constructed as part of the San Gabriel River and Montebello Forebay water conservation system to impound runoff from the San Gabriel Mountains prior to release for downstream spreading and groundwater recharge. Runoff in the San Gabriel River is captured by three dams in San Gabriel Canyon: Cogswell Dam on the West Fork, San Gabriel Dam below the confluence of the East and West Forks of the San Gabriel River, and Morris Dam, a few miles downstream of San Gabriel Dam. Once released from the upper canyon facilities, runoff flows to Santa Fe Dam and may be diverted to the Santa Fe spreading grounds, located off-river along the northern boundary of the dam, or conveyed downstream to the Rio Hondo and San Gabriel Coastal Basin Spreading Grounds.

On tributaries to the Los Angeles River, the Big Tujunga and Pacoima dams provide similar functions. LACFCD also oversees 17 inflatable rubber dams throughout the Los Angeles River basin. Most are used to divert flows into the spreading grounds, although several rubber dams in the San Gabriel watershed also promote short-term groundwater recharge through the stream bottom. Dams, spreading grounds and surface storage in the Region are depicted in Map 2-9.

The Region's spreading grounds are used to recharge local surface water in addition to imported water and recycled water. LACFCD has estimated that current recharge of local surface water is 220,000 AFY, and could potentially be increased by another 340,000 AFY during very wet years to offset imported water recharge.

Las Virgenes MWD purchases treated water from MWD and stores it in Las Virgenes Reservoir, in the City of Westlake Village. The reservoir also provides seasonal water storage allowing Las Virgenes MWD to purchase supplies off-season and deliver at times of peak demand to meet high summer irrigation needs.

The in-city water distribution systems of the City of Los Angeles once included 15 open-air reservoirs. Due to concerns from California Department of Public Health (CDPH) about open water storage, nine of these reservoirs have been bypassed, replaced, or covered. Los Angeles Reservoir is one of the last remaining open reservoirs. It has a capacity of 10,000 AF and is a primary water source of the San Fernando Valley area. LADWP does not consider removal of the Los Angeles Reservoir a viable option. To protect its water quality, a floating cover was proposed.


Dams, Spreading Grounds and Reservoirs
Integrated Regional Water Management Plan
Map 2-9
Rivers and Streams
Spreading Grounds
Dams, Reservoirs
Subregions
Miles
0 2.5 5 10
Sources: Cal-Atlas, LACDPW
CRYSTAL LAKE
SAN GABRIEL DAM
COGSWELL DAM
MORRIS DAM
BIG DALTON DAM
SAN DIMAS DAM
LIVE OAK DAM
LIVE OAK S.G.
THOMPSON CK S.G.
SAN GABRIEL CANYON S.G.
FORBES S.G.
PUDDINGSTONE DAM
CITRUS S.G.
BEN LOMOND S.G.
WALNUT S.B.
SAWPIT DAM
SANTA FE DAM
IRWINDALE S.B.
SAN GABRIEL RIVER (UPPER)
SIERRA MADRE DAM
SANTA ANITA DAM
BUENA VISTA S.B.
PECK ROAD S.B.
WHITTIER NARROWS DAM
SAN GABRIEL COASTAL BASIN S.G.
SAN GABRIEL RIVER (LOWER)
EATON WASH DAM
EATON S.B.
ARROYO SECO S.G.
DEVILS DAM
EAGLE ROCK DAM
HIGHLAND DAM
ASCOT DAM
LAGUNA DAM
GARVEY RESERVOIR
RIO HONDO COASTAL BASIN S.G.
DOMINGUEZ GAP S.G.
BIG TUJUNGA DAM
TUJUNGA S.G.
GLORIETTA RESERVOIR
HEADWORKS S.G.
ROWENA DAM
SILVER LAKE DAM
MULHOLLAND DAM
PACOIMA DAM
LOPEZ S.G.
HANSEN DAM
BRANFORD S.B.
PACOIMA S.G.
TUJUNGA S.G.
LOS ANGELES RESERVOIR
SEPULVEDA DAM
LOWER VAN NORMAN DAM
ENCINO DAM
LOWER FRANKLIN DAM
STONE CANYON DAM
CHATSWORTH RESERVOIR
PALO VERDES RESERVOIR
WESTLAKE LAKE
MALIBU LAKE
LAKE SHERWOOD
LAS VIRGENES RESERVOIR

Water Use Efficiency

Water use efficiency, though by definition the implementation of measures that reduce water demand, is addressed in greater detail in the supply discussion. Water purveyors in the Region have implemented a large number of programs that encourage the use of best management practices to reduce demand. In 2010 Urban Water Management Plans, urban water suppliers were required to comply with conservation targets laid out in the Water Conservation Bill of 2009 which sets water conservation targets for 2015 and 2020 to support an overall State goal of reducing urban potable per capita water use by 20% by 2020. As part of this work, the Region's suppliers have estimated current water use efficiency to save 50,000 AFY of water supply, and estimates that this can increase to 125,000 AFY.

2.6 Water Supply and Demand

As water agency boundaries are not aligned with the Region's boundaries, an estimate of the Region's water supply and demand was not readily available for this Plan. Instead, water supply and demand for the Region were estimated based on review of 2010 UWMPs, groundwater basin master plans, and meetings with water agencies' staff. The 2010 UWMPs, which are used as the primary source of water supply and demand projections, were prepared by urban water suppliers to support long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands over a 20-year planning horizon.

A representative group of urban water suppliers in the Region were chosen based on service area coverage of the Region, and their supplies and demands as listed in their planning documents were totaled to determine the 2010 supplies and demands for the Region. Retail supply and demand is shown in Table 2-1, while replenishment supply is shown in Table 2-2. Detailed information on supply and demand by water supplier may be found in Appendix E.

There are currently no environmental flow requirements in the Region's waterways, and therefore not included in the below supply and demand totals.

Table 2-1: Retail Water Supply and Demand (AFY)[1]

Water Category	2010
Imported Water	935,000
Groundwater Pumping	570,000
Local Surface Water Diversions	15,000
Recycled Water (non-potable reuse)	75,000
Stormwater Capture and Direct Use	0
Desalinated Ocean Water	0
Water Use Efficiency/Conservation[2]	50,000
Total Retail Supply	**1,645,000**
Total Retail Demand	**1,515,000**

1. Values have been rounded up to the nearest 5,000 AFY.
2. Not all agencies reported conservation as a form of supply in 2010 UWMPs. Some agencies included as a reduction in demand.

Table 2-2: Replenishment Water (AFY)[1]	
Water Category	**2010**
Imported Water	75,000
Local Surface Water Diversions	190,000
Recycled Water	50,000
Total Replenishment Water	**325,000**

1. Values have been rounded up to the nearest 5,000 AFY.

2.7 Water Quality

More than two centuries of agricultural, industrial, and residential development and the widespread use of chemicals, fertilizers, industrial solvents, and household products, has resulted in water quality degradation of varying degrees in both surface water and groundwater in the Region. These sources of degradation can be classified as either point or nonpoint sources. Point sources are the discrete (or known) discharge of water and/or wastes to the soil, groundwater, or surface waters. Common examples include wastewater treatment plants, industrial discharges and leaking underground storage tanks. Nonpoint sources are area-wide discharges to soil, groundwater, and surface waters, such as the application of fertilizers, atmospheric deposition of contaminants, and litter such as trash and plant materials. Point sources can be traced back to a single source, such as the end of a pipe, while nonpoint sources have widespread origins. Although many stormwater contaminants come from nonpoint sources, as the discharge of stormwater typically occurs via an individual storm drain or channel, stormwater discharge is regulated as a point source.

Water Quality Issues

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. Amended in 1977, this law, commonly known as the Clean Water Act, established the basic structure for regulating discharges of pollutants into the waters of the United States and gave the USEPA the authority to implement pollution control programs. In California, per the Porter Cologne Water Quality Control Act of 1969, responsibility for protecting water quality rests with the SWRCB and the RWQCBs.

The SWRCB sets statewide policies and develops regulations for the implementation of water quality control programs mandated by state and federal statutes and regulations. The RWQCBs develop and implement Basin Plans designed to preserve and enhance water quality. The determination of whether water quality is impaired is based on the designated beneficial uses of individual water bodies and associated water quality criteria, which are established in the Basin Plan. As mandated by Section 303(d) of the Federal Clean Water Act, the SWRCB maintains and updates a list of "impaired" water bodies that exceed state and federal water quality standards. To address these impairments, the RWQCBs develop total maximum daily loads, or TMDLs, which would establish a maximum pollutant budget that can be discharged without impairing the designated beneficial uses. In addition to development of the TMDLs, the RWQCBs develop and implement the National Pollutant Discharge Elimination System (NPDES) permits for wastewater treatment plants and other point source dischargers to surface water bodies in the Region (shown in Map 2-10).

Even though agencies and cities in the Region have significantly reduced pollutants that are discharged to water bodies from individual point sources since the Clean Water Act was established, many of the major rivers and water bodies are still considered impaired due to trash, bacteria, nutrients, metals, and/or toxic pollutants. The quality of many water bodies continues to be degraded from pollutants discharged from diffuse and diverse nonpoint sources, and from the cumulative impacts of multiple point sources. As a result, many of the Region's creeks, rivers, and water bodies are

WATER QUALITY ISSUES

Figure 2-1. Water Quality Issues. Volunteers on creek clean up duty. Dry weather and stormwater runoff creates significant water quality problems in the Region.

included on the most recent 2010 update of the 303(d) list of impaired water bodies, as depicted on Maps 2-11(a) through 2-11(d). A number of TMDLs were adopted over the last decade and various water quality improvement projects and programs are being implemented by point source and non-point source dischargers including the counties and the cities in the Region.

Residential use of potable water, the importation of water, the use of recycled water, among other activities, all have the potential to increase the level of total dissolved solids (TDS) in surface water, wastewater, and groundwater. With naturally occurring elevated levels of TDS already present in both local surface water and groundwater, the need to manage salt levels has been recognized for some time.

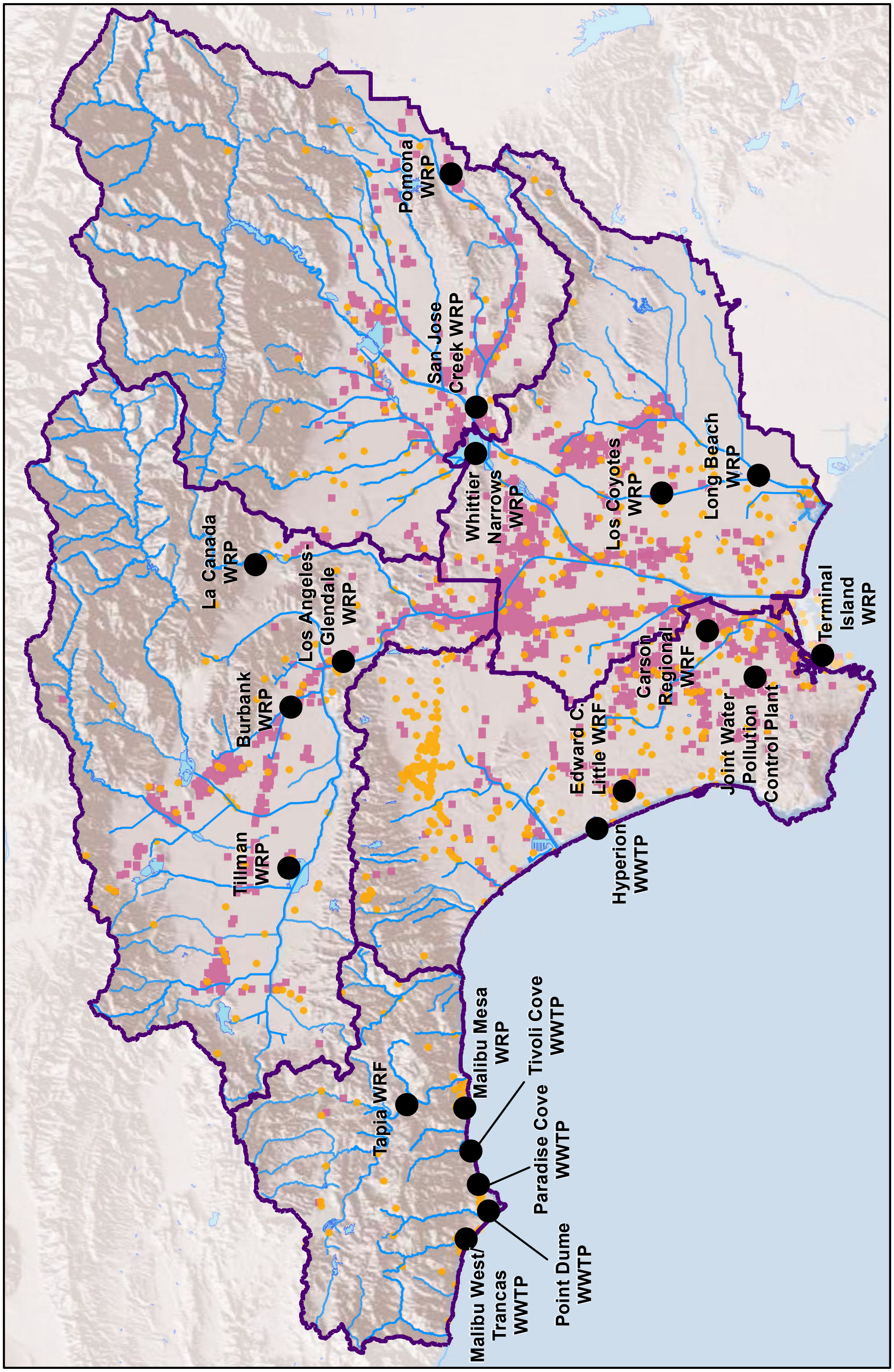
The transfer of water within the Region and the recharge of imported water have both been limited due to concerns about potential water quality impacts which include high salinity levels. Higher TDS source water also poses a problem for water recycling facilities because conventional treatment processes are typically designed to remove suspended, but not dissolved, particles and thus more advanced treatment methods may be required. Several water and wastewater agencies in the Region are members of the Southern California Salinity Coalition, which in conjunction with the National Water Research Institute, seeks to coordinate efforts to address the critical need to remove salt from water supplies and preserve water resources. In addition, the State Water Resources Control Board adopted a Recycled Water Policy in February 2009 that requires Salt and Nutrient Management Plans be completed by 2014 to facilitate management of salts and nutrients from all sources in order to protect beneficial uses.[1]

Local Surface Water Quality

Throughout the Region's watersheds, surface water quality is typically better in the upper reaches and headwaters and declines as it receives urban and stormwater runoff in the lower watershed before discharging into the Pacific Ocean. Common contaminants in urban and stormwater runoff in the Region are described below.

Sediment is a common component of stormwater, and can be a pollutant at certain levels. Sediment can be detrimental to aquatic life by interfering with photosynthesis, respiration, growth, reproduction, and oxygen exchange in water bodies. Sediment can also transport other pollutants that are attached to it including nutrients, trace metals, and hydrocar-

1. *State Water Resources Control Board (SWRCB), 2012. Salt and Nutrient Management Program. http://www.waterboards.ca.gov/losangeles/water_issues/programs/salt_and_nutrient_management/index.shtml*



Wastewater Treatment Plants, Water Reclamation Plants & Discharge Permits

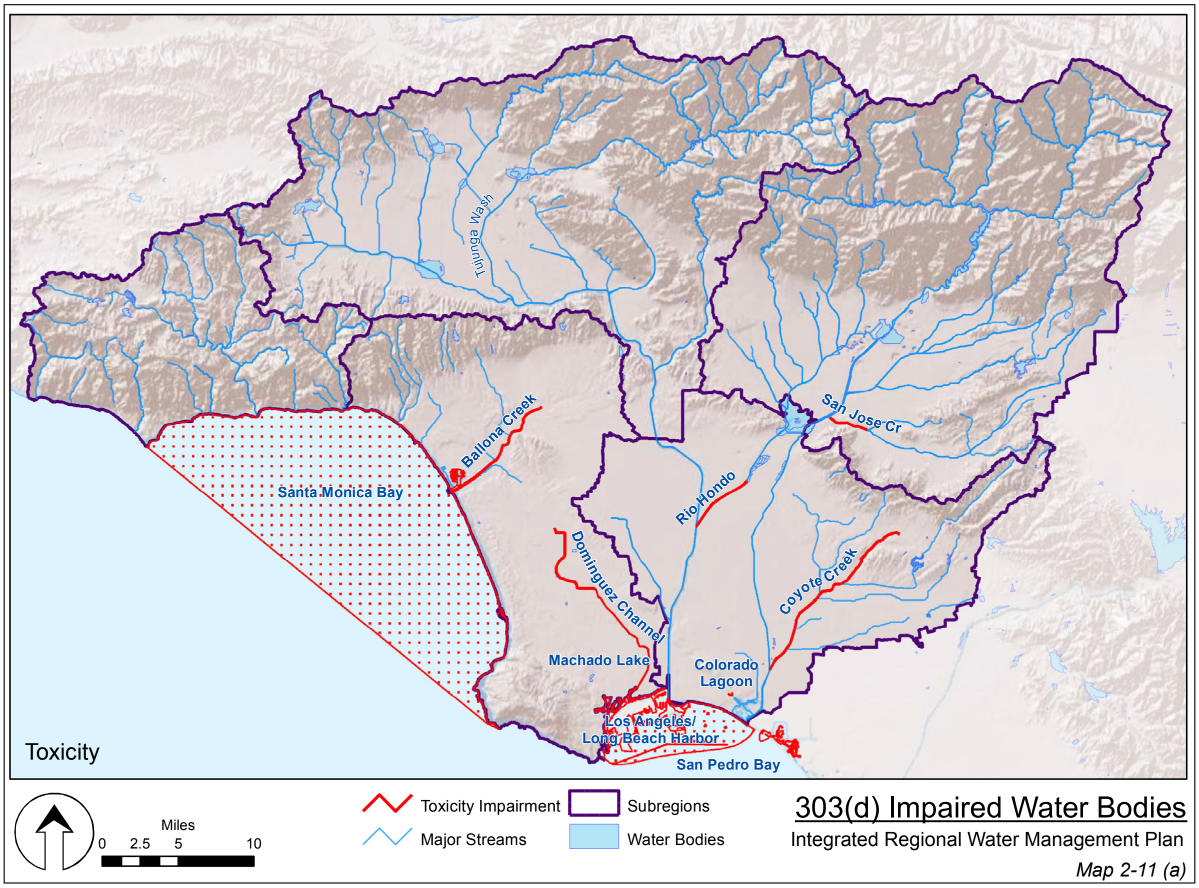
Integrated Regional Water Management Plan

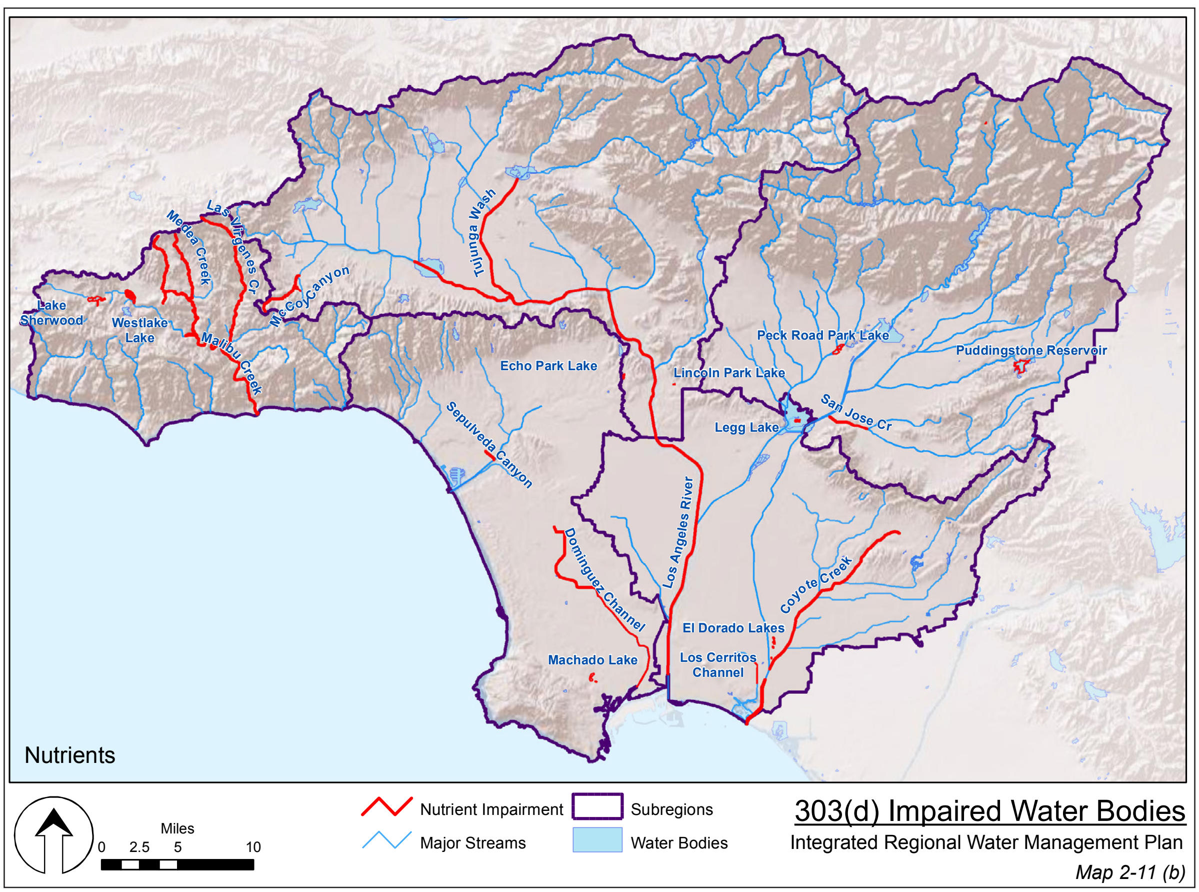
Map 2-10

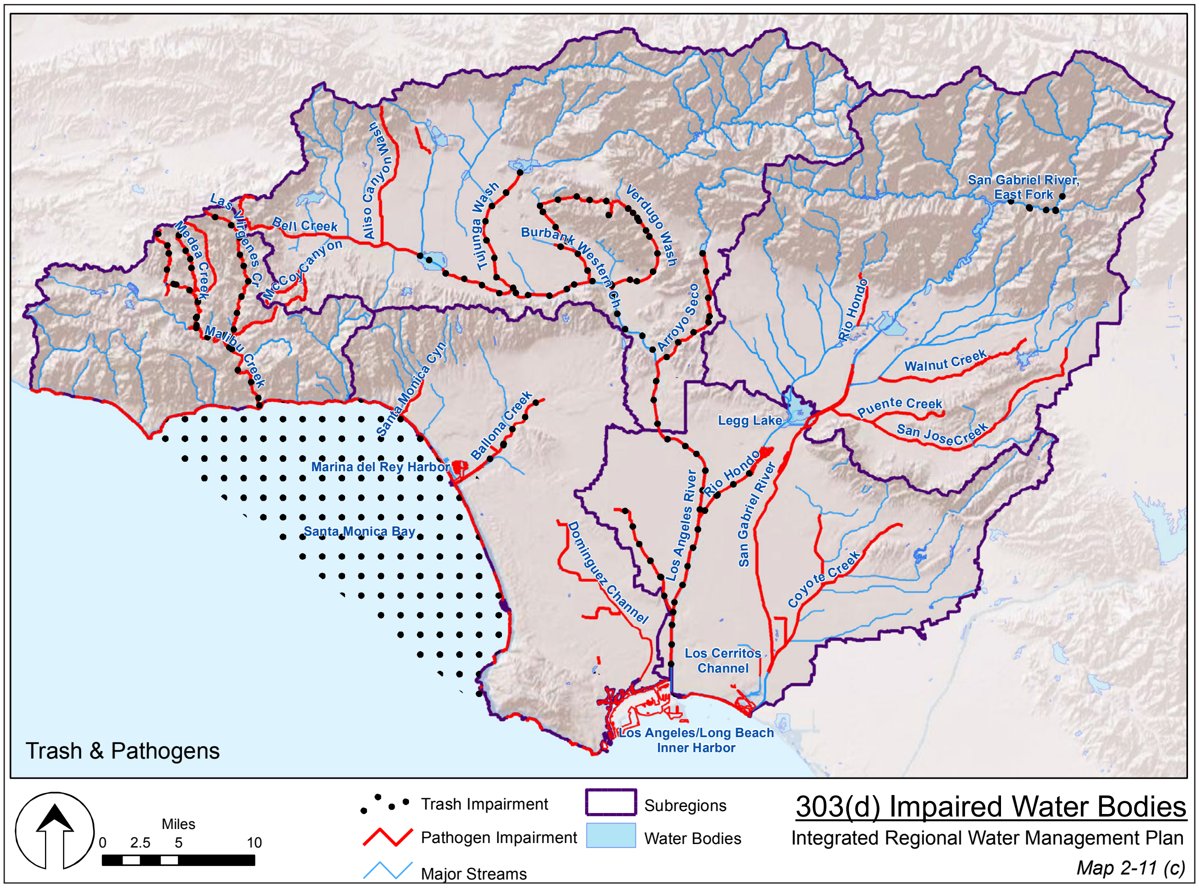
- Municipal Discharge Permit
- Industrial Discharge Permit
- WWTPs & WRPs
- Subregions

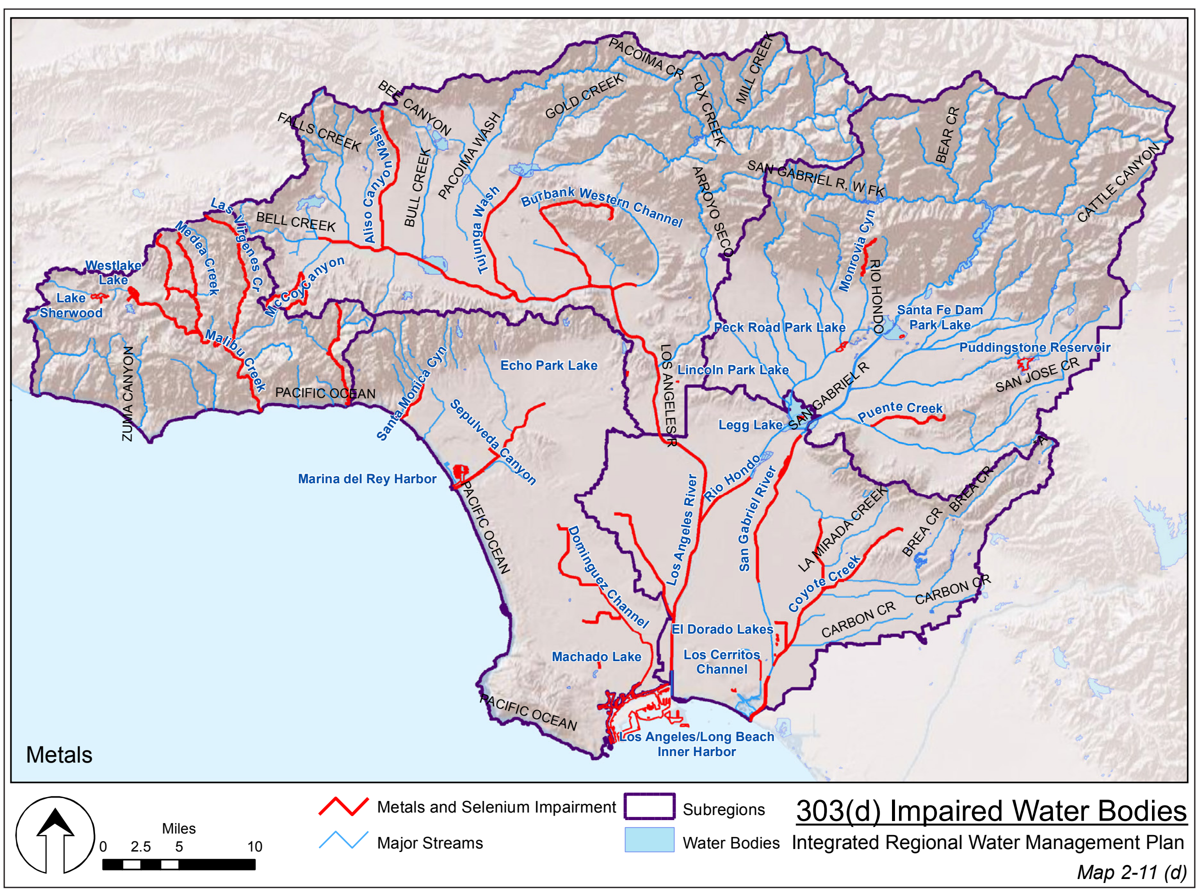
Miles: 0, 2.5, 5, 10

Sources: Cal-Atlas, ESRI, LACDPW, LA RWQCB


Tujunga Wash
San Jose Cr
Ballona Creek
Santa Monica Bay
Rio Hondo
Dominguez Channel
Coyote Creek
Machado Lake
Colorado Lagoon
Los Angeles/ Long Beach Harbor
San Pedro Bay
Toxicity
Miles
0 2.5 5 10
Toxicity Impairment
Major Streams
Subregions
Water Bodies
303(d) Impaired Water Bodies
Integrated Regional Water Management Plan
Map 2-11 (a)


Las Virgenes Cr.
Medea Creek
Tujunga Wash
McCoy Canyon
Lake Sherwood
Westlake Lake
Malibu Creek
Echo Park Lake
Peck Road Park Lake
Puddingstone Reservoir
Lincoln Park Lake
Legg Lake
San Jose Cr
Sepulveda Canyon
Los Angeles River
Dominguez Channel
Coyote Creek
El Dorado Lakes
Los Cerritos Channel
Machado Lake
Nutrients
Miles
0 2.5 5 10
Nutrient Impairment
Major Streams
Subregions
Water Bodies
303(d) Impaired Water Bodies
Integrated Regional Water Management Plan
Map 2-11 (b)


Trash & Pathogens
San Gabriel River, East Fork
Verdugo Wash
Burbank Western Ch.
Tujunga Wash
Aliso Canyon Wash
Bell Creek
Las Virgenes Cr.
Medea Creek
McCoy Canyon
Malibu Creek
Arroyo Seco
Rio Hondo
Walnut Creek
Puente Creek
San JoseCreek
Legg Lake
Santa Monica Cyn
Ballona Creek
Marina del Rey Harbor
Santa Monica Bay
Dominguez Channel
Los Angeles River
San Gabriel River
Coyote Creek
Los Cerritos Channel
Los Angeles/Long Beach Inner Harbor
Miles
0 2.5 5 10
Trash Impairment
Pathogen Impairment
Major Streams
Subregions
Water Bodies
303(d) Impaired Water Bodies
Integrated Regional Water Management Plan
Map 2-11 (c)


Metals
PACOIMA CR
FOX CREEK
MILL CREEK
GOLD CREEK
BEE CANYON
FALLS CREEK
Aliso Canyon Wash
BULL CREEK
PACOIMA WASH
Tujunga Wash
Burbank Western Channel
ARROYO SECO
SAN GABRIEL R, W FK
BEAR CR
CATTLE CANYON
Monrovia Cyn
RIO HONDO
Las Virgenes Cr.
BELL CREEK
Medea Creek
McCoy Canyon
Westlake Lake
Lake Sherwood
Malibu Creek
ZUMA CANYON
PACIFIC OCEAN
Santa Monica Cyn
Echo Park Lake
Sepulveda Canyon
LOS ANGELES R
Lincoln Park Lake
Peck Road Park Lake
Santa Fe Dam Park Lake
Puddingstone Reservoir
SAN JOSE CR
SAN GABRIEL R
Legg Lake
Puente Creek
Marina del Rey Harbor
Rio Hondo
Los Angeles River
San Gabriel River
LA MIRADA CREEK
BREA CR
BREA CR
Coyote Creek
CARBON CR
CARBON CR
Dominguez Channel
El Dorado Lakes
Los Cerritos Channel
Machado Lake
Los Angeles/Long Beach Inner Harbor
Miles
0 2.5 5 10
Metals and Selenium Impairment
Major Streams
Subregions
Water Bodies
303(d) Impaired Water Bodies
Integrated Regional Water Management Plan
Map 2-11 (d)

Santa Monica Beach. Continual improvement of the Region's surface water quality supports recreation at its many beaches.

bons. Erosion and subsequent sedimentation is a natural process of the highly-erodible San Gabriel and Santa Monica Mountains. Other sources of sediment include stream banks, bridge pilings, vacant lots, and construction sites.

Nutrients, including nitrogen and phosphorous, are critical to the growth of plants. However, elevated nutrient levels can result in excessive or accelerated growth of vegetation, such as algae, which can result in water quality impairment. Common sources of nutrients include fertilizers used in landscaping and agriculture, human and animal waste, effluent from wastewater treatment facilities, and can be naturally elevated from local petroleum shales.

Bacteria and viruses are common contaminants in both urban runoff and stormwater. High levels of indicator bacteria (such as Escherichia coli) in stormwater sometimes results in the closure of beaches to contact recreation. Sources include sanitary sewer leaks and spills, illicit connections of sewer lines to the storm drain system, malfunctioning septic tanks, and fecal matter from humans, pets, and wildlife.

Oil and grease includes a wide array of hydrocarbon compounds, some of which are toxic to aquatic organisms at low concentrations. Sources of oil and grease include leakage from tanks, pipelines and old extraction sites, accidental spills, cleaning of vehicles and equipment, leaks in hydraulic systems, and the improper disposal of restaurant wastes and used oil.

Metals found in the Region's urban and stormwater runoff include lead, zinc, cadmium, copper, chromium, nickel, and mercury. Metals can be toxic to aquatic organisms at a trace concentration and mercury can bioaccumulate (accumulate to toxic levels in animals such as fish or birds). Many artificial surfaces of the urban environment (e.g., galvanized metal, paint, automobiles and brake pads, or preserved wood) contain metals, which enter stormwater as those surfaces corrode, flake, dissolve, decay, or leach. During storms, many of the metals present in stormwater are attached to sediments.

Organic compounds (e.g., adhesives, cleaners, sealants, solvents, etc.) and pesticides (e.g., herbicides, fungicides, rodenticides, and insecticides) may be found in urban and stormwater runoff in low concentrations. The widespread use of these substances and their improper disposal are the common sources of these compounds. Bioaccumulation of pesticides can have adverse effects on aquatic life and the animals that consume that life (e.g., seabirds that eat fish). Some of these substances were prohibited long ago due to negative impacts but are still detected in low concentrations (such as dichloro-diphenyl-trichloroethane [DDT]) and are now termed "legacy" pollutants.

Trash, debris, and other floatables are the result of the improper use, storage, and disposal of packaging and other products in urban environments, plant debris (such as leaves and lawn-clippings from landscape maintenance), animal excrement, street litter, and other organic matter. In addition to negative aesthetic impacts, these substances may harbor bacteria, viruses, and vectors.

During the last decade, over 30 TMDLs have been developed to address water quality impairments within the Region, with a number of impaired waters yet to be addressed. Various water quality improvement projects and programs are being implemented by point and non-point source dischargers including the counties, the cities in the Region and other responsible agencies such as park agencies and the California Department of Transportation. Table 2-3 contains a listing of TMDLs and Table 2-4 contains a list of 303(d) listed waters and impairments not yet addressed by a TMDL.

Watershed management plans have been developed for watersheds within the Region to help to guide future land use planning and projects, and improve the state of the watershed. Various agencies have developed management plans for the following watersheds:

- Los Angeles River
- San Gabriel River
- Santa Monica Bay
- Dominguez Channel
- Ballona Creek (part of the Santa Monica Bay Watersheds)
- Arroyo Seco (subwatershed of the L.A. River)
- Sun Valley (subwatershed of the L.A. River)

Table 2-3: Adopted TMDLs (as of 2012)

- Ballona Creek Estuary Toxic Pollutants TMDL
- Ballona Creek Metals TMDL
- Ballona Creek Trash TMDL
- Ballona Creek Wetlands Sediment and Invasive Exotic Vegetation TMDL
- Ballona Creek, Ballona Estuary, and Sepulveda Channel Bacteria TMDL
- Colorado Lagoon Pesticides, PAHs, PCBs, Metals, etc. TMDL
- Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL
- Echo Park Lake TMDLs
- El Dorado Park Lakes Multiple TMDLs
- El Dorado Park Lakes Copper TMDL
- Lake Calabasas TMDLs
- Legg Lake Trash TMDL
- Lincoln Park Lake TMDLs
- Long Beach City Beaches and Los Angeles River Estuary TMDLs for Indicator Bacteria
- Los Angeles Harbor Bacteria TMDL
- Los Angeles Area Lakes Nitrogen, Phosphorus, Mercury, Trash, Organochlorine Pesticides and PCBs TMDLs
- Los Angeles River Bacteria TMDL
- Los Angeles River Metals TMDL
- Los Angeles River Nutrient TMDL
- Los Angeles River Trash TMDL
- Los Cerritos Channel Metals TMDL
- Machado Lake Nutrient TMDL
- Machado Lake Toxics TMDL
- Machado Lake Trash TMDL
- Malibu Creek Bacteria TMDL
- Malibu Creek Nutrient TMDL
- Malibu Creek Trash TMDL
- Marina del Rey Harbor Toxics TMDL
- Marina del Rey Harbor, Mothers' Beach and Back Basins Bacteria TMDL
- North, Center, and Legg Lake Multiple TMDLs
- Peck Road Park Lake TMDLs
- Puddingstone Reservoir TMDLs
- San Gabriel River East Fork Trash TMDL
- San Gabriel River Metals TMDL
- Santa Fe Dam Park Lake TMDL
- Santa Monica Bay Beaches Dry Weather Bacteria TMDL
- Santa Monica Bay Beaches Wet Weather Bacteria TMDL
- Santa Monica Bay DDTs and PCBs TMDL
- Santa Monica Bay Nearshore Debris TMDL

Table 2-4: 303(d) Listed Waters without an adopted TMDL (as of 2012)

- **Alamitos Bay:** Bacteria
- **Arroyo Seco:** Benthic-Macroinvertebrate Bioassessments
- **Ballona Creek:** Cyanide, Shellfish harvesting advisory
- **Ballona Creek Wetlands:** Shellfish harvesting advisory
- **Burbank Western Channel:** Cyanide
- **Compton Creek:** Benthic Community Effects
- **Coyote Creek:** Diazinon, Toxicity, Ammonia, pH, Bacteria
- **Crystal Lake:** Organic Enrichment/Low Dissolved Oxygen
- **Dominguez Channel:** Ammonia, Indicator Bacteria
- **Dominguez Channel Estuary:** Ammonica, Coliform Bacteria, Benthic Community Effects
- **Lake Lindero:** Chloride, Selenium, Specific Conductivity
- **Lake Sherwood:** Mercury
- **Las Virgenes Creek:** Benthic-Macroinvertebrate Bioassessments, Invasive Species, Sedimentation/Siltation, Selenium
- **Lindero Creek:** Benthic-Macroinvertebrate Bioassessments, Selenium, Invasive Species
- **Los Angeles Harbor:** Benthic Community Effects
- **Los Angeles River Estuary:** Chlordane, PCBs, DDT, Sediment Toxicity
- **Los Angeles River:** Cyanide, DDT, Oil, Diazinon, Dieldrin, Dibenz[a,h]anthracene
- **Los Cerritos Channel:** Ammonia, DEHP, Chlordane, Bacteria, Trash, pH
- **Malibu Beach:** DDT
- **Malibu Creek:** Benthic-Macroinvertebrate Bioassessments, Selenium, Invasive Species, Fish Barriers, Sedimentation/Siltation, Sulfates
- **Malibu Lagoon Beach (Surfrider):** Benthic Community Effects, DDT, PCBs
- **Medea Creek:** Benthic-Macroinvertebrate Bioassessments, Selenium, Invasive Species, Sedimentation/Siltation
- **Rio Hondo:** Cyanide, Oil, Diazinon
- **San Gabriel River Estuary:** Dioxin, Dissolved Oxygen
- **San Gabriel River:** Bacteria, Cyanide, pH
- **San Jose Creek:** TDS, pH
- **San Pedro Bay:** Chlordane, DDT, PCBs, Sediment Toxicity, ChemA, Bacteria, Nitrogen/Nitrate, Toxaphene, Toxicity
- **Santa Monica Canyon:** Bacteria, Copper, Lead, Selenium, Ammonia
- **Sawpit Creek:** Bis(2ethylhexyl)phthalate (DEHP), Fecal Coliform
- **Topanga Creek:** Lead
- **Torrance Carson Channel:** Coliform Bacteria
- **Triunfo Creek:** Lead, Mercury, Sedimentation/Siltation, Benthic-Macroinvertebrate Bioassessments
- **Walnut Creek Wash:** Benthic-Macroinvertebrate Bioassessments, Indicator Bacteria, pH
- **Wilmington Drain:** Coliform Bacteria

Groundwater Quality

Groundwater quality varies throughout the Region, based on naturally occurring conditions, historical land use patterns, and groundwater extraction patterns.

Naturally occurring soil and geologic conditions in the Region often result in elevated levels of dissolved solids in groundwater (measured in terms of TDS). Commonly referred to as "hard" water, these dissolved solids include inorganic salts (including calcium, magnesium, potassium,sodium, bicarbonates, chlorides and sulfates) and small amounts of organic matter. Increases in groundwater TDS concentrations are a function of the recharge of storm and urban runoff, imported water, and incidental recharge. Naturally hard water precludes the use of groundwater throughout one of the GLAC IRWMP Subregions, the North Santa Monica Bay Subregion. They are also attributed in part to the legacy of salt contamination from past agricultural and land uses, including fertilizer use and waste disposal.

Groundwater quality in some portions of the Region has been degraded by elevated levels of nitrates primarily from past agricultural land use practices and plumes of volatile organic compounds (VOCs) from the past disposal of industrial solvents. These include trichloroethylene (TCE), a common degreaser and cleaning product, and perchloroethylene (PCE), commonly used in dry cleaning of clothing. In addition, perchlorate contamination, associated with the manufacturing and testing of solid rocket propellants, is another major concern. The solid salts of ammonium perchlorate, potassium perchlorate, or sodium perchlorate are soluble in water and can persist for decades. Groundwater contamination has also occurred in some locations from the use of methyl tertiary butyl ether (MTBE) a gasoline additive used to increase octane ratings and reduce emissions. Although the use of MTBE was discontinued in 2003 (following the discovery of MTBE in groundwater wells in the City of Santa Monica), many underground gasoline storage tanks leaked and created the potential for contamination. Groundwater cleanup efforts are being coordinated by various agencies and cities, including the San Gabriel Basin WQA and WRD.

The following is a summary of water quality issues in each of the Region's groundwater basins:

- **Main San Gabriel Basin:** VOCs, NDMA, nitrate, perchlorate, and TDS
- **Puente Basin:** TDS, nitrate, VOCs
- **Six Basins:** nitrate, perchlorate, VOCs, arsenic, radon
- **Raymond Basin:** TDS, nitrate, perchlorate, VOCs
- **San Fernando Basin:** TCE, PCE, hexavalent chromium, nitrate, sulfate, TDS
- **Verdugo Basin:** MTBE, nitrate
- **Sylmar Basin:** nitrate
- **Central Basin:** TDS, VOCs, perchlorate, nitrate, iron, manganese, chromium
- **West Coast Basin:** TDS
- **Santa Monica Basin:** TCE, PCE, perchlorate, MTBE
- **Hollywood Basin:** TDS

The cost of treating these contaminants so that groundwater supplies can be optimized is often significant. Additionally, effective treatment has not yet been identified for some chemicals and testing needs to be performed of different treatment methods prior to identifying the preferred treatment alternative. Some of the contamination is extensive and several sites are on USEPA's National Priorities List for remediation. The cost to treat this groundwater is typically in the millions of dollars.

One example is the Baldwin Park area where VOCs have been detected at 1000 times above the established maximum contaminant levels (MCLs). Although responsible parties, who are obligated to pay for the remediation, were identified, it has taken years for this remediation project to begin. Although the VOCs were identified in the 1980s and an agreement was reached in the late 1990s to begin treatment, other contaminants were subsequently found and new treatment methods had to be identified. In 2000, treatment of the VOCs, N-nitrosodimethylamine (NDMA), and perchlorate began. Additional programs are planned or underway.

The extraction of groundwater above natural replenishment levels and the subsequent intrusion of seawater have adversely affected groundwater quality at some coastal locations in the Region since the 1940's. Seawater intrusion can degrade water quality such that wells become unusable and reduce available aquifer storage. Los Angeles County operates and maintains three seawater intrusion barrier systems along the coast that utilize treated wastewater and imported water to reduce the seawater intrusion in coastal aquifers.

2.8 Environmental Resources

Historical Wetlands

California is estimated to have lost over 90 percent of its coastal wetlands since the 1850s due to development, according to the California Coastal Commission. According to the Coastal Conservancy, within the Los Angeles River watershed, 100 percent of the original lower riverine and tidal marsh and 98 percent of all inland freshwater marsh and ephemeral ponds have been drained or filled (California Resources Agency, 2001).

Ballona Wetlands is a large historical wetland adjacent to the Marina Del Rey small craft harbor.

Similar loss occurred with the channelization and improvement of the Region's creeks. Currently, two expansive areas of coastal wetlands remain: the Los Cerritos wetlands complex, and the Ballona wetlands and lagoons near the mouth of Ballona Creek. Other remaining historic wetland areas include the El Dorado wetlands near the confluence of Coyote Creek and the San Gabriel River; the lower reach of Compton Creek where the channel bottom is unlined; some limited saltwater marsh along the banks at the lowest reach of the Los Angeles River (SCWRP, 2001 and Resources Agency, 2001), and the coastal lagoons in the North Santa Monica Bay Watersheds, including Malibu, Trancas, Topanga, Zuma and Las Flores lagoons.

After a long history of widespread destruction and degradation, wetlands have belatedly been recognized as performing many valuable, even critical roles in the environment. Wetlands can function as sources, sinks and transformers of chemical, genetic and biological materials. They have been likened to "the kidneys of the landscape" for the role they play in hydrologic and chemical cycles, and in improving water quality (Mitsch & Gosselink, 1986). Functional wetlands (e.g., those that retain their natural ecological functions) have been shown to cleanse polluted waters, prevent or mitigate floods, protect shorelines and channel banks, and recharge groundwater aquifers. Additionally, wetlands provide unique and critical habitats for large numbers of flora and fauna. Thus, expansion and restoration of existing wetlands which retain natural functions, and development of constructed wetlands which recreate natural functions have the potential to improve water quality, improve flood protection, restore or create habitat, and enhance groundwater recharge.

There are many different ways to categorize or define aquatic habitats, including approaches based on various ecological or regulatory perspectives. For this Plan, rather than use the term "wetland", which might have unintended associations, the term "aquatic habitat" is used to refer to land transitional between terrestrial and aquatic systems where the water table is usually at or near ground surface or the land is covered by shallow water.

Aquatic habitat can be categorized into three general categories: (1) tidal aquatic habitat, (2) freshwater aquatic habitat, and (3) riverine (or riparian) aquatic habitat based on categories defined by the National Wetland Inventory (NWI). Although incomplete, the NWI is a very important source of information for the present aquatic habitat conditions with the GLAC. Larger, regional areas that function as off-system detention and storage would be considered freshwater aquatic habitat. While it is recognized that rivers and stream beds are not always considered aquatic habitats, for they do provide some aquatic habitat value, and therefore are considered for this study. The definition for each of these categories is as follows:

- Tidal aquatic habitats
- Freshwater aquatic habitats
- Riverine aquatic habitats

Tidal Aquatic Habitat

Tidal aquatic habitats include aquatic habitats that are inundated by tides, either seasonally or year-round. Marine harbors, a man-made habitat, are also considered tidal aquatic habitats. In the NWI mapping system, the three categories included in tidal aquatic habitats are estuarine and marine deepwater, estuarine and marine aquatic habitat, and tidal aquatic habitats.

Freshwater Aquatic Habitat

Freshwater aquatic habitats include aquatic habitats such as depressional marshes, lakes, and ponds. The NWI category "freshwater aquatic habitats" include freshwater emergent aquatic habitat, freshwater forested/shrub aquatic habitat, freshwater ponds and lakes, and also considers man-made habitats such as flood control basins and ponds which may include areas of freshwater aquatic habitats. It is an important distinction that although spreading grounds and some stormwater Best Management Practices, such as detention basins, swales, and depressional areas, also provide ecosystem benefits, they belong under a separate category and should not be subject to the same protection criteria.

Riverine Aquatic Habitat

Riverine aquatic habitats include the streambed and associated riparian areas, including upper and lower riverine habitats and dry washes. Man-made habitats considered riverine aquatic habitats include concrete-lined channels and soft-bottomed channels. Note that "riparian" is sometimes used to mean riverine aquatic habitats. Because of its common usage, the terms are used interchangeably here. However, strictly speaking, riparian refers to the vegetated habitat adjacent to streams, rivers, lakes, reservoirs and other inland aquatic systems. This habitat is typically a linear corridor of variable width that occurs along perennial, intermittent, and ephemeral streams and rivers. In undisturbed areas, two distinguishing features of riparian ecosystems are the hydrologic interaction that occurs between the stream channel and adjacent areas through periodic exchange of surface water and groundwater, and the distinctive geomorphic features and vegetation communities that develop in response to this hydrologic interaction.

Due to the extensive urbanization on the coastal plain and inland valleys, current riverine aquatic habitat within the Region bears little resemblance to the pre-development conditions. Faber et al. (1989) estimated that 90 to 95 percent of the riparian habitat has been lost. Most native riverine aquatic habitat in the Region is located in the Santa Monica and San Gabriel Mountains, although some riverine aquatic habitat corridors occur along the upper and middle reaches of the San Gabriel River, including portions of Walnut, San Jose, and Coyote Creeks, the Chino, Puente, and Simi Hills, and the Verdugo and Santa Susana Mountains. In-stream habitat also occurs in the upper San Gabriel River and streams in the San Gabriel foothills, the Whittier Narrows, Sepulveda Basin, Hansen Dam, and the Glendale Narrows. Although the San Gabriel Mountains contain some large areas of quality riverine aquatic habitat, much of the other riverine aquatic habitat in the Region is increasingly stressed by recreational use, exotic species, hydrologic modifications, natural disturbance such as fires and drought, and encroaching development. In regional parks, recreation areas, and other protected areas, patches of natural or nearly natural habitat of varying size remain, supporting native species of plants and animals. Substantial portions of the remaining riverine aquatic habitat are located on private lands.

Where riverine aquatic habitats remain within or adjacent to urbanized areas, conditions are often impaired by degraded water quality, altered hydrologic conditions, encroachment on, and modification of, adjacent "buffer" habitat, and modified sediment transport. Water quality impairments generally include increases in 1) water temperature; 2) nontoxic elements such as sediment and nutrients; and 3) toxic contaminants such as pesticides and heavy metals. Since functional riparian vegetation and wetlands can improve water quality by removing or sequestering many contaminants, the widespread loss of riparian and aquatic habitat and/ or reduction of their normal functions have reduced the potential for these natural systems to enhance water quality, provide flood protection, recharge groundwater, and serve as wildlife corridors.

Significant Ecological Areas and Environmentally Sensitive Habitat Areas

Significant Ecological Areas (SEAs) are ecologically important areas that are designated by the County of Los Angeles as having valuable plant or animal communities. Similar to the SEAs are Environmentally Sensitive Habitat Areas (ESHAs), which are designated by the Coastal Commission via local coastal programs. Terrestrial or aquatic habitat can qualifies for recognition as an SEA or

ESHA if the habitat possesses one or more of the following features, or classes:

- Habitat of rare, endangered, or threatened plant or animal species;
- Represents biotic communities, vegetative associations, or habitat of plant or animal species that are either one-of-a-kind, or are restricted in distribution on a regional basis;
- Represents biotic communities, vegetative associations, or habitat of plant or animal species that are either one-of-a-kind, or are restricted in distribution in Los Angeles County;
- Habitat that at some point in the life cycle of a species or group of species serves as a concentrated breeding, feeding, resting, or migrating grounds, and is limited in availability;
- Represents biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or they represent an unusual variation in a population or community;
- An area important as game species habitat or as fisheries;
- An area that would provide for the preservation of relatively undisturbed examples of the natural biotic communities in Los Angeles County; and
- A special area worthy of inclusion, but one that does not fit any of the other seven criteria.

Rindge Dam is an example of aging infrastructure as well as a major barrier to Steelhead Migration in the Malibu Creek Watershed.

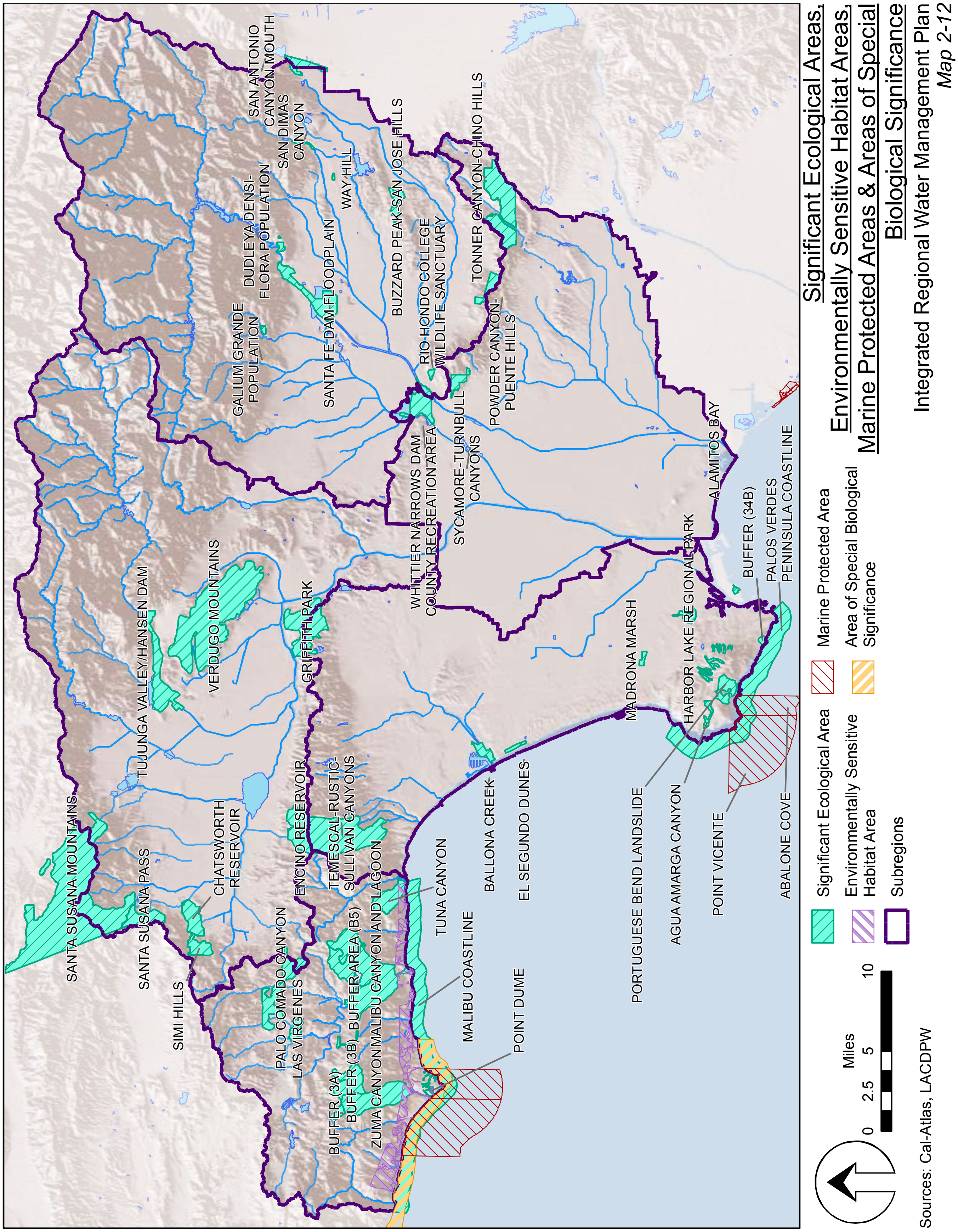
SEAs are offered certain protections within the unincorporated portions of Los Angeles County. Development proposals located within a SEA and outside incorporated City boundaries are reviewed by the Significant Ecological Area Technical Advisory Committee (SEATAC) which recommends changes to the project and mitigation measures to protect the habitat. The County of Los Angeles is in the process of updating the SEA designations and policies. Current SEAs within Los Angeles County are depicted on Map 2-12.

Areas of Special Biological Significance

In the mid-1970s, to protect sensitive coastal habitats, the SWRCB designated 34 areas on the coast of California as ASBS, including the area between Mugu Lagoon in Ventura County and Latigo Point in Los Angeles County. Several watersheds in the North Santa Monica Bay drain to the eastern portion of this ASBS, between Sequit Point (near the Los Angeles County line) and Latigo Point, which begins at the intertidal zone and extends 1,000 feet from the shore (or to a depth of 100 feet, whichever is greater). The California Coastal Commission has designated all watershed lands adjacent to an ASBS as Critical Coastal Areas (CCA). Thus, development in this CCA and runoff from that area is subject to special conditions.

The land form along this portion of the ASBS generally consists of a coastal bluff with cliffs along the shoreline, except at Zuma Beach, where the coastal bluff is separated from the shore by a wide sandy beach. Vegetation types in the adjacent onshore areas include coastal strand, coastal sage scrub and riparian woodland (where several intermittent streams reach the coast). Subtidal habitat types along this ASBS include exposed rock reefs and kelp beds, semi-protected sandstone reefs and kelp beds, shallow sands, and deeper sands along most of the ASBS (SWRCB, 1979).

Runoff in this area includes stormwater discharge from roads (including State Highway 1) and some dry-weather urban runoff from the residential development along the coast and in upland areas. Several beaches along this area are 303(d) listed for beach closures and high coliform bacteria counts.



Significant Ecological Areas, Environmentally Sensitive Habitat Areas, Marine Protected Areas & Areas of Special Biological Significance

Integrated Regional Water Management Plan
Map 2-12

The Public Resources Code prohibits the discharge of point source waste and thermal discharges into an ASBS, except by special conditions. In addition, the California Ocean Plan prohibits the discharge of dry-weather runoff from nonpoint sources into an ASBS. In 2012, the City of Malibu and the County of Los Angeles were granted a general exemption to the California Ocean Plan Waste Discharge Prohibition for discharges of stormwater. The exception is subjected to special conditions, such as elimination of dry weather flows, control of stormwater pollutants, and extensive monitoring.

2.9 Open Space and Recreation

The Region's open space resources are extensive, due to the presence of large portions of the Angeles National Forest and the Santa Monica Mountains National Recreation Area. The benefits of open space lands within the Region, whether in public or private ownership, are numerous. These natural areas provide large expanses of open space, which absorb rainfall that contributes to groundwater recharge and produce runoff that feeds local streams and the Region's two major rivers, and so provides a substantial portion of the Region's local water supply.

Additionally, the physical benefits of open space are complemented with economic benefits that open space provides to those who live near open space lands and to entire communities. Ecosystem services provide one approach for framing the values and benefits of open space. Ecosystem services are the benefits people obtain from ecosystems. The Millennium Ecosystems Assessment (2005) has presented a scheme for classifying ecosystem services using four general categories:

- **Provisioning services** such as food, water, timber, and fiber
- **Regulating services** that affect climate, floods, disease, wastes, and water quality
- **Cultural services** that provide recreational, aesthetic, and spiritual benefits
- **Supporting services** such as soil formation, photosynthesis, and nutrient cycling

Aquatic habitats provide services in all four categories, as is shown in Table 2-5 (Vymazal, 2011). Aquatic habitat ecosystems reduce flood damage to human communities, sequester carbon, and reduce pollutants in runoff entering streams (Brauman et al., 2007). Aquatic habitats support consumptive uses such as hunting and fishing as well as non-consumptive uses such as bird watching. Zedler and Kersher, 2008, consider four of the many functions performed by aquatic habitats to have global significance and value as ecosystem services: biodiversity support, water quality improvement, flood abatement, and carbon management.

Upland habitats also provide a wide range of ecosystem services. As with aquatic habitats, uplands provide biodiversity support and support consumptive uses such as hunting as well as non-consumptive uses such as recreation and education.

The preservation of environmental resources within open space and recreation areas is generally promoted by the Land Management Plan for the Southern California Forests and the Santa Monica Mountains Comprehensive Plan. Additional open space is located in the undeveloped portions of the foothills south of the Angeles National Forest, and throughout the Santa Monica, Santa Susanna and Verdugo Mountains, the Baldwin, Chino, and Puente Hills, and the Palos Verdes Peninsula. Protection of the open space in these areas is generally the responsibility of local Park Agencies and General Plans.

Baldwin Hills is one of the few remaining preserves of large open space in the heart of the Region.

Table 2-5: Examples of Services Provided by Aquatic Habitats	
Provisioning Services	
Food	Production of fish, wild game, fruits, grains
Fresh water	Storage and retention of water for domestic, industrial and agricultural use
Fiber and fuel	Production of logs, fuel-wood, peat, fodder
Biochemical	Extraction of medicines and other materials from biota
Genetic materials	Genes for resistance to plant pathogens, ornamental species
Regulating Services	
Climate regulation	Source of and sink for greenhouse gases; influence local and regional temperature, precipitation, and other climate processes
Water regulation (hydrological flows)	Groundwater recharge/discharge; flow attenuation
Water purification and waste treatment	Retention, recovery, and removal of excess nutrients and other pollutants
Erosion regulation	Retention of soils and sediments
Natural hazard regulation	Food control; storm protection
Pollination	Habitat for pollination
Cultural Services	
Spiritual and inspirational	Source of inspiration; many religions attach spiritual and religion values to aspects of aquatic habitat ecosystems
Recreational	Opportunities for recreational activities
Aesthetic	Many people find beauty or aesthetic value in aspects of aquatic habitat ecosystems
Educational	Opportunities for formal and informal education and training
Supporting Services	
Soil formation	Sediment retention and accumulation of organic matter
Nutrient cycling	Storage, recycling, processing, and acquisition of nutrients

Preservation of such spaces can protect existing water resources and native habitat, as these open spaces absorb rainfall, produce runoff that feeds local streams, and may contribute to groundwater. Watershed and open space plans, such as Common Ground from the Mountains to the Sea, also promote the preservation of these areas.

Excluding the large open spaces and other state lands in the upper portions of the watersheds, within the urbanized portions of the Region, there are over 1,000 parks with a combined total area of approximately 31,800 acres. Major open spaces and parks are depicted on Maps 2-13(a) through 2-13(e). With a current population of approximately 9.6 million, the Region has approximately 3.3 acres of parkland per 1,000 residents (excluding Angeles National Forest Lands), although considerable variation exists between the Subregions. In some communities, which are proximate to large open spaces, access to parkland with active recreational opportunities is limited. Most municipalities within the Region use a standard of four acres of parkland per 1,000 residents and six acres of open space per 1,000 residents. Thus, current parkland in the Region is below this identified minimum recommendation.

Open space used for recreation and public access has the potential to optimize use of local water resources by preserving or enhancing groundwater recharge, and thereby improving water supply reliability and providing opportunities to reuse stormwater or recycled water for irrigation improve surface water quality, to the extent that it filters, retains, or detains stormwater runoff (although few existing parks or open spaces include specific features to improve the quality of stormwater runoff).

2.10 Ecological Processes

Although large portions of the Region have been subject to urban and suburban development, ecological processes still play an important role in the management of water resources. The large expanses of open space in the upper watersheds of the Los Angeles and San Gabriel Rivers and throughout the Santa Monica Mountains provide a substantial portion of Region's water supply.

Fire is an integral and necessary part of the natural environment and plays a role in shaping the landscape, yet fire frequency has increased due to human ignition with increasing populations and human activity which has resulted in open spaces with varying fuel loads. Catastrophic wildfire events can denude hillsides which create opportunities for invasive plants and increase the potential for subsequent rains to result in debris flows that erode the landscape and can clog stream channels, damage structures, and injure inhabitants in the canyons and lower foothill areas.

Invasive species in the Region have also substantially affected specific habitats and areas. Along with the rest of California, most the Region's native grasslands were long ago displaced by introduced species. The receptive climate has resulted in the widespread importation of plants from around the globe for landscaping. Some plant introductions have resulted in adverse impacts. In many undeveloped areas, non-native plants such as arundo (*Arundo donax*), tree of heaven (*Alianthus altissima*) tree tobacco (*Nicotiana glauca*), castor bean (*Ricinus communis*), salt cedar (*Tamarix ramosissima*) and cape ivy (*Senecio mikanioides*) are out-competing native species because they are not edible to wildlife or lack natural predators such as disease and insects. Arundo, a tall bamboo-like grass that is prolific and difficult to eradicate, is probably the most invasive of the exotic plant species. In riparian areas, it takes up large amounts of water, crowds out native plants, clogs streams, and disrupts the balance for aquatic species. The removal of this particular species, which requires focused and repeated efforts, can provide substantial dividends in water savings and restored species diversity.

As noted earlier, limited aquatic habitat remains within those areas subject to development. In locations where such habitat exists, contact with water is critical to long-term viability. To the extent that channelization of streams prevents natural percolation of water into the soil, and in some locations, the return of baseflow to stream channels, the continued presence of aquatic vegetation cannot be ensured. The presence of riparian vegetation within soft-bottom portions of the rivers (e.g., the Los Angeles River in the Sepulveda Basin and Elysian Valley, the Rio Hondo in Whittier Narrows, and many locations along the San Gabriel River) creates habitat that has become dependent on runoff, which in some locations is supplemented by recycled water discharge from wastewater treatment plants. Consequently, the removal or redirection of that flow could adversely affect habitat in those locations. In addition, the proposed restoration of steelhead fisheries in the Santa Monica Mountains, such as Malibu Creek, may require that some recycled water discharge be maintained.

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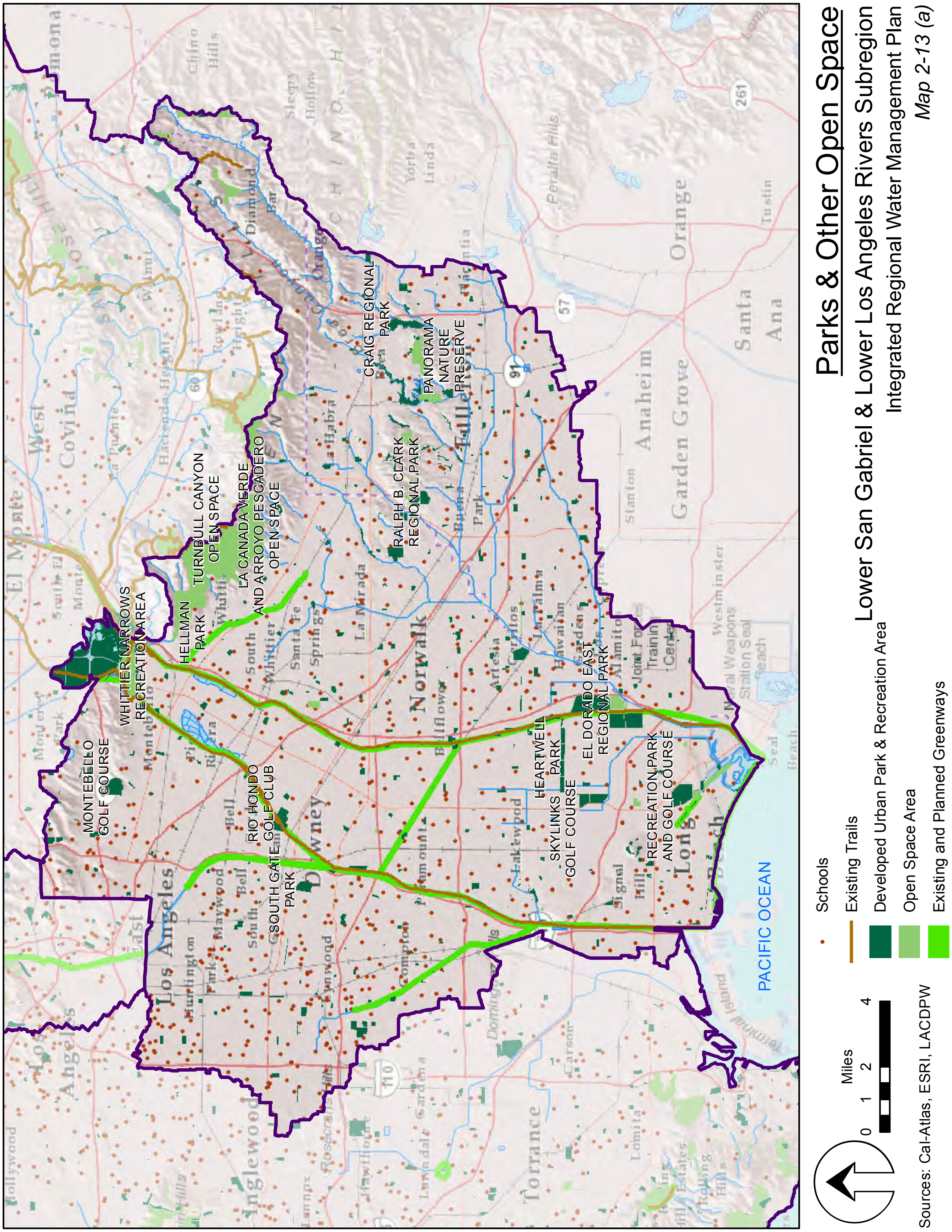
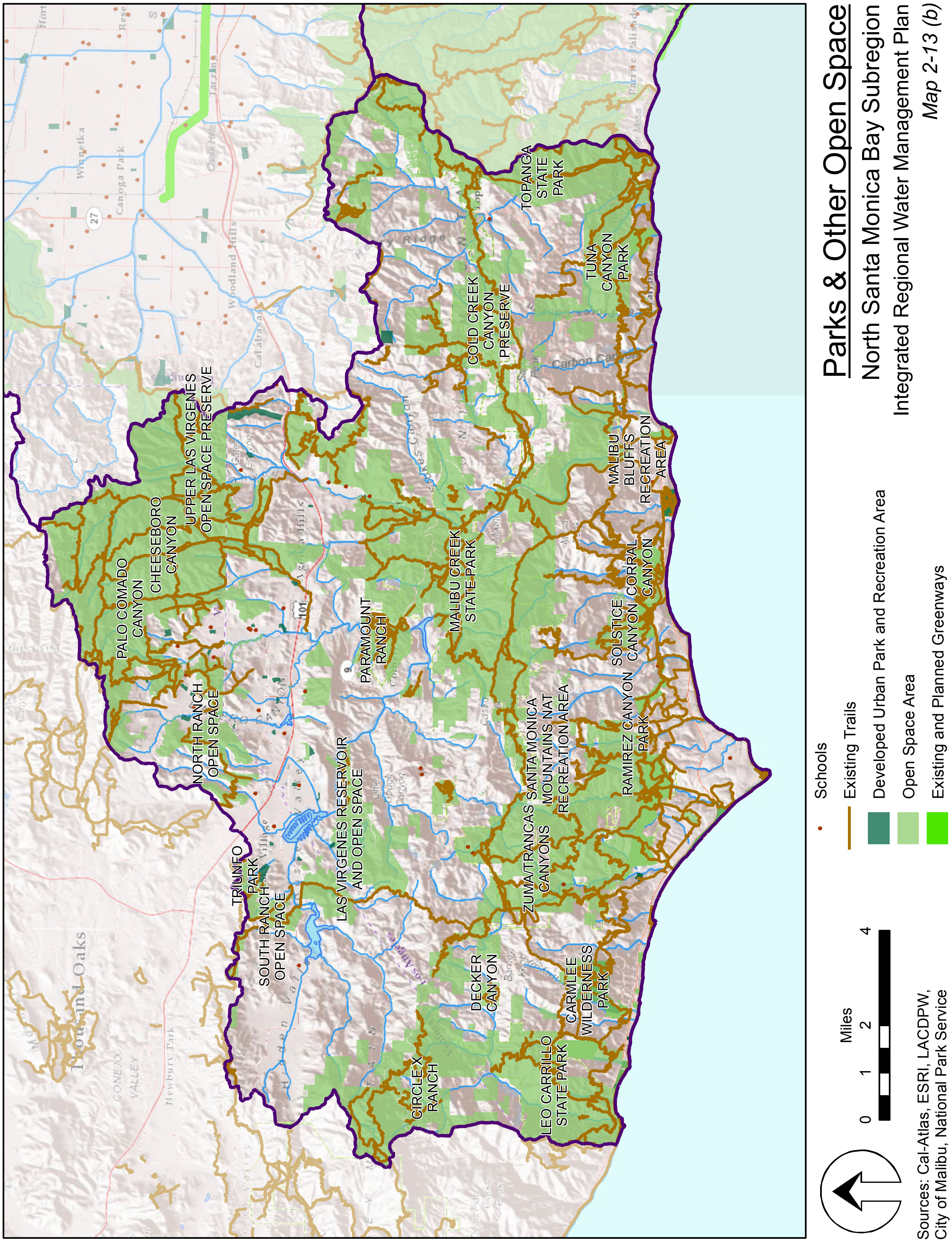


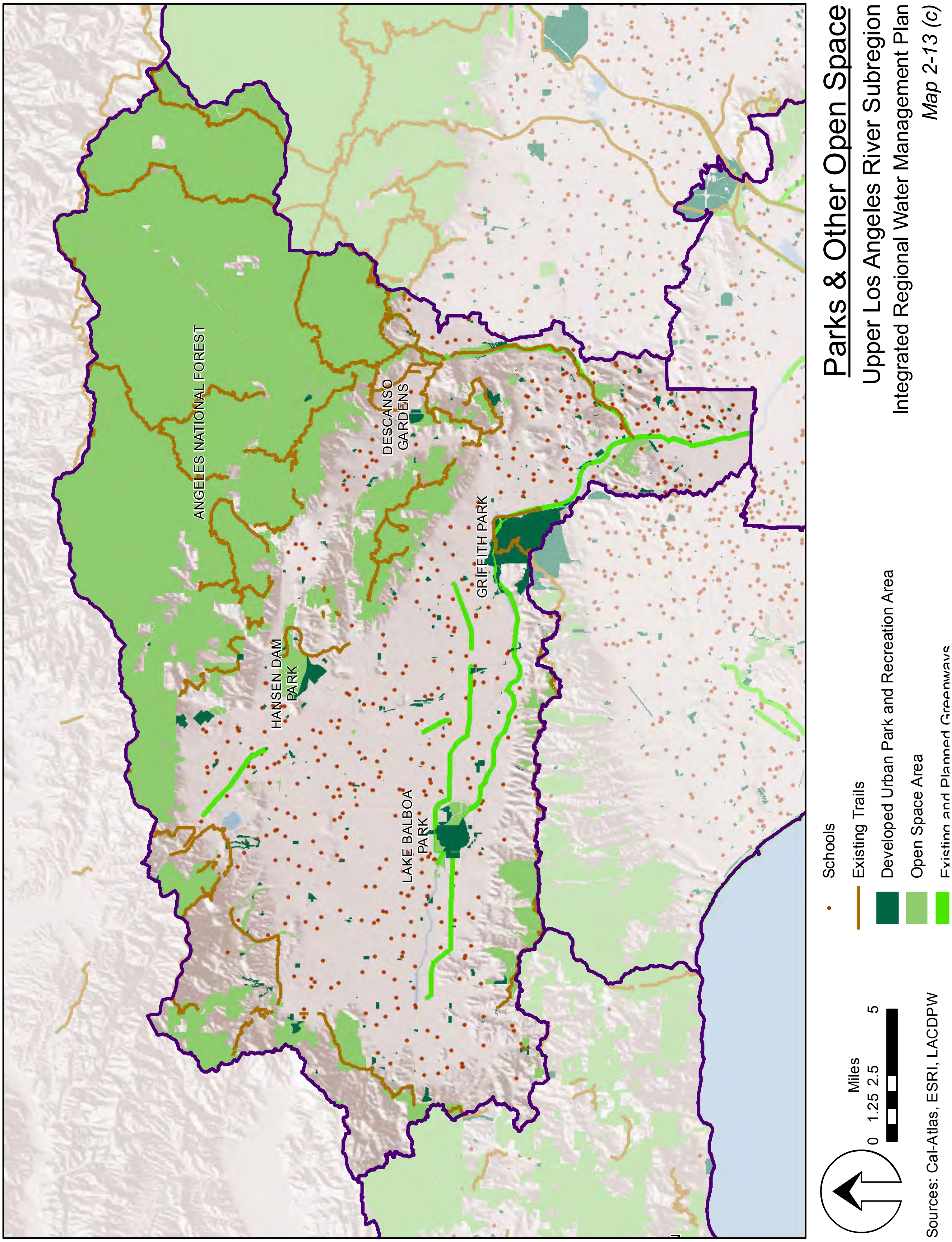
Parks & Other Open Space

Lower San Gabriel & Lower Los Angeles Rivers Subregion

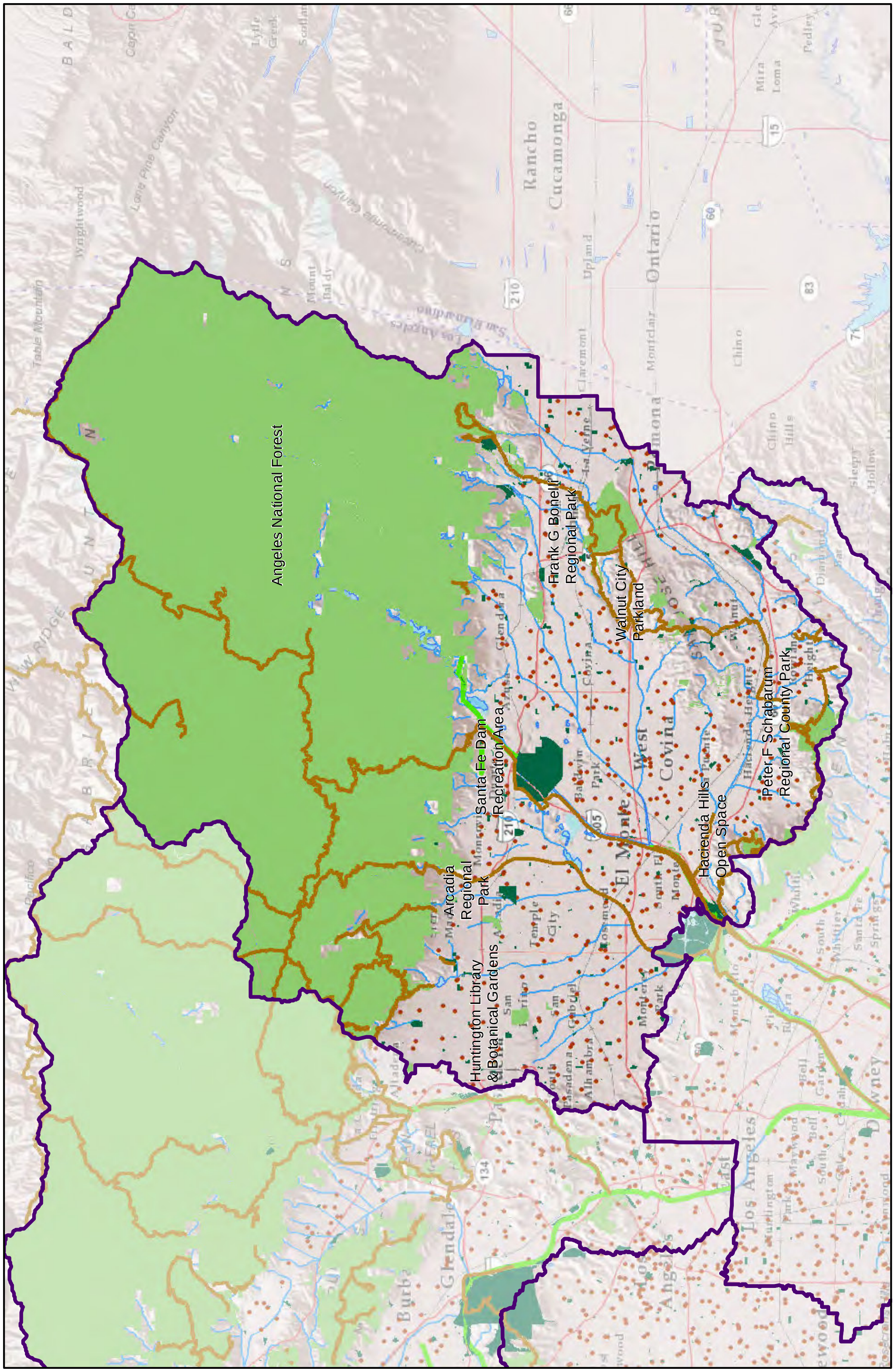
Integrated Regional Water Management Plan

Map 2-13 (a)


Parks & Other Open Space
North Santa Monica Bay Subregion
Integrated Regional Water Management Plan
Map 2-13 (b)
Schools
Existing Trails
Developed Urban Park and Recreation Area
Open Space Area
Existing and Planned Greenways
Miles
0
1
2
4
Sources: Cal-Atlas, ESRI, LACDPW,
City of Malibu, National Park Service
TOPANGA STATE PARK
TUNA CANYON PARK
COLD CREEK CANYON PRESERVE
MALIBU BLUFFS RECREATION AREA
UPPER LAS VIRGENES OPEN SPACE PRESERVE
CHEESEBORO CANYON
PALO COMADO CANYON
MALIBU CREEK STATE PARK
CORRAL CANYON
SOLSTICE CANYON
PARAMOUNT RANCH
NORTH RANCH OPEN SPACE
SANTA MONICA MOUNTAINS NAT RECREATION AREA
RAMIREZ CANYON PARK
LAS VIRGENES RESERVOIR AND OPEN SPACE
TRIUNFO PARK
SOUTH RANCH OPEN SPACE
ZUMA/TRANCAS CANYONS
DECKER CANYON
CARMLEE WILDERNESS PARK
CIRCLE X RANCH
LEO CARRILLO STATE PARK
Thousand Oaks
Canoga Park
Winnetka
Woodland Hills
Calabasas
Carbon Canyon



Parks & Other Open Space
Upper Los Angeles River Subregion
Integrated Regional Water Management Plan
Map 2-13 (c)
ANGELES NATIONAL FOREST
DESCANSO GARDENS
GRIFFITH PARK
HANSEN DAM PARK
LAKE BALBOA PARK
Schools
Existing Trails
Developed Urban Park and Recreation Area
Open Space Area
Existing and Planned Greenways
Miles
0 1.25 2.5 5
Sources: Cal-Atlas, ESRI, LACDPW



Parks & Other Open Space

Upper San Gabriel River & Rio Hondo Subregion

Integrated Regional Water Management Plan

Map 2-13 (d)

Schools

Existing Trails

Developed Urban Park and Recreation Area

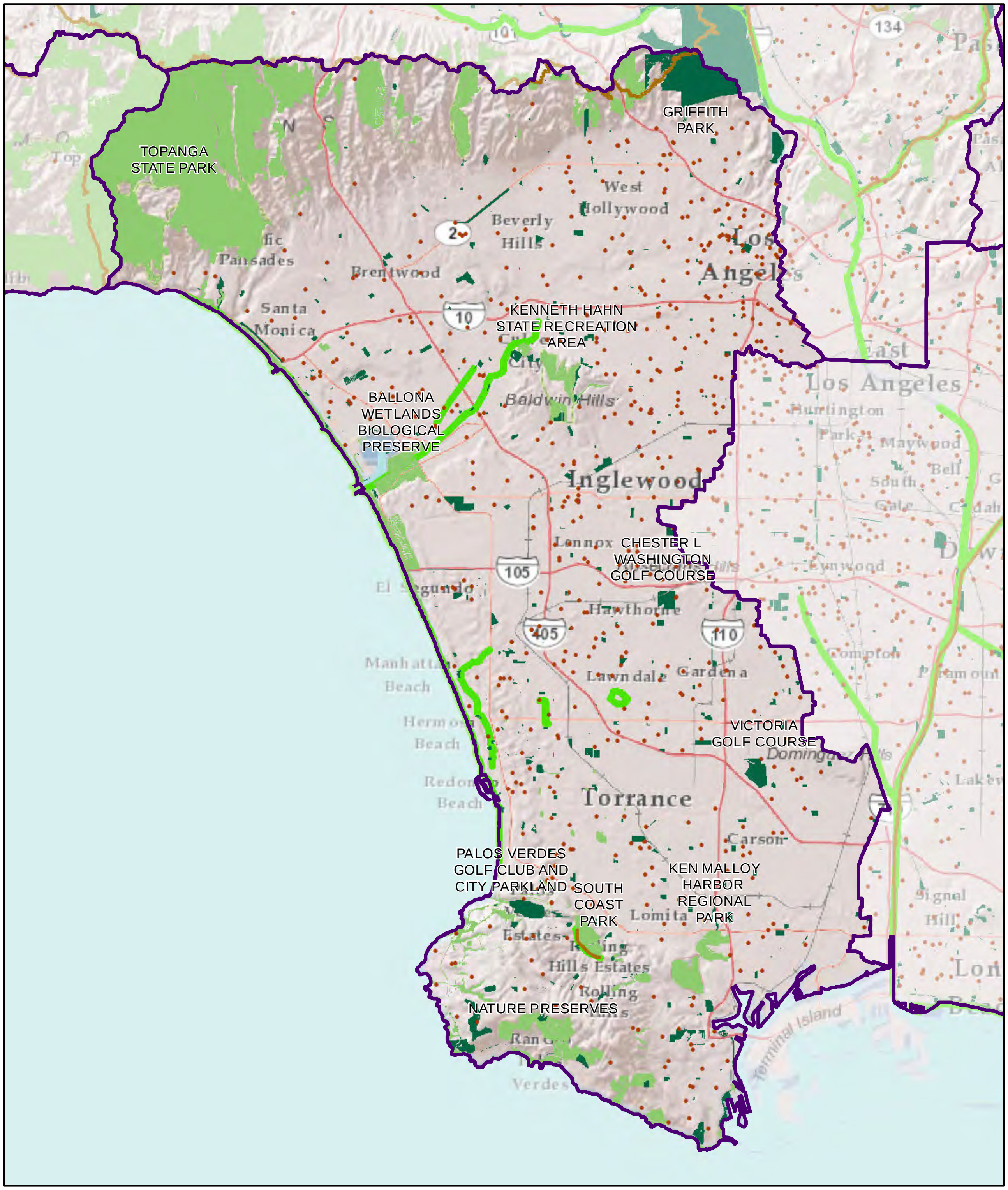
Open Space Area

Existing and Planned Greenways

Miles

0 1 2 4

Sources: Cal-Atlas, ESRI, LACDPW



- Schools
- Existing Trails
- Developed Urban Park & Recreation Area
- Open Space Area
- Existing & Planned Greenways

Miles

0 1 2 4

Sources: Cal-Atlas, ESRI, LACDPW

Parks & Other Open Space

South Bay

Integrated Regional Water Management Plan

Map 2-13 (e)

2.11 Land Use

Land Use within the Region reflects the historic pattern of urbanization, as most of the coastal plain and interior valleys are occupied with residential, industrial, commercial, and institutional uses, and most of the foothills and mountains are principally open space. A breakdown of land use in the Region is provided in Table 2-6, and depicted on Maps 2-14(a) through 2-14(e).

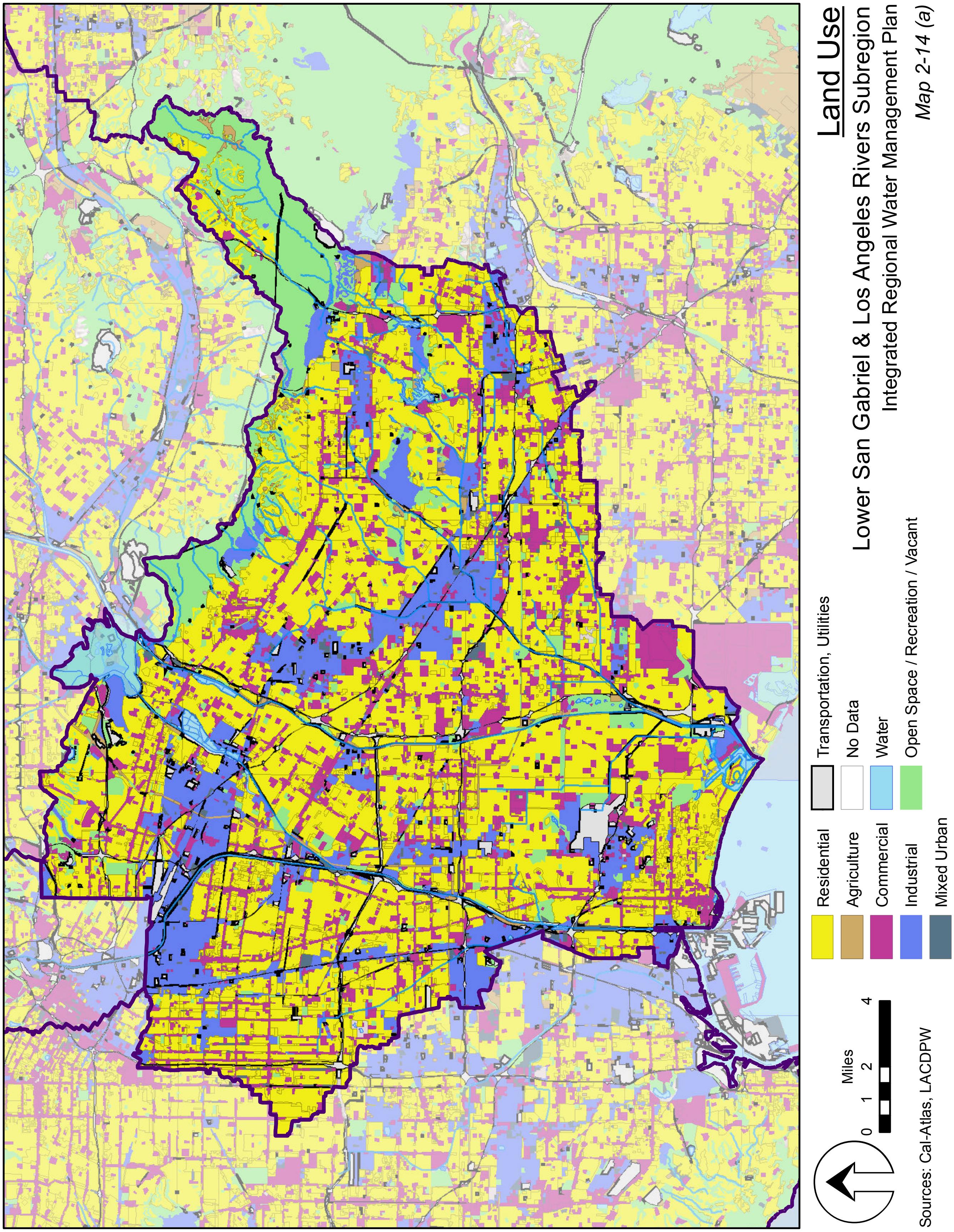
The dominant land use types are defined as follows:

- Residential: duplexes and triplexes, single family residential, apartments and condominiums, trailer parks, mobile home courts and subdivisions
- Commercial: parking facilities, colleges and universities, commercial recreation, correctional facilities, elementary/middle/high schools, fire stations, government offices, office use, hotels and motels, health care facilities, military air fields, military bases, military vacant area, strip development, police and sheriff stations, pre-schools and day care centers, shopping malls, religious facilities, retail centers, skyscrapers, special care facilities, and trade schools
- Industrial: chemical processing, metal processing, manufacturing and assembly, mineral extractions, motion picture, open storage, packing houses and grain elevators, petroleum refining and processing, research and development, wholesaling and warehousing
- Transportation and Communication: airports, bus terminals and yards, communication facilities, electrical power facilities, freeways and major roads, harbor facilities, improved flood waterways and structures, maintenance yards, mixed transportation and utility, natural gas and petroleum facilities, navigation aids, park and ride lots, railroads, solid and liquid waste disposal facilities, truck terminals, water storage and transfer facilities
- Open Space / Recreation / Vacant: beach parks, cemeteries, golf courses, developed and undeveloped parks, publically-owned open space, parks and recreation, specimen gardens and arboreta, wildlife preserves and sanctuaries, national forest lands, urban vacant, abandoned orchards and vineyards, undifferentiated, and vacant land with limited improvements.

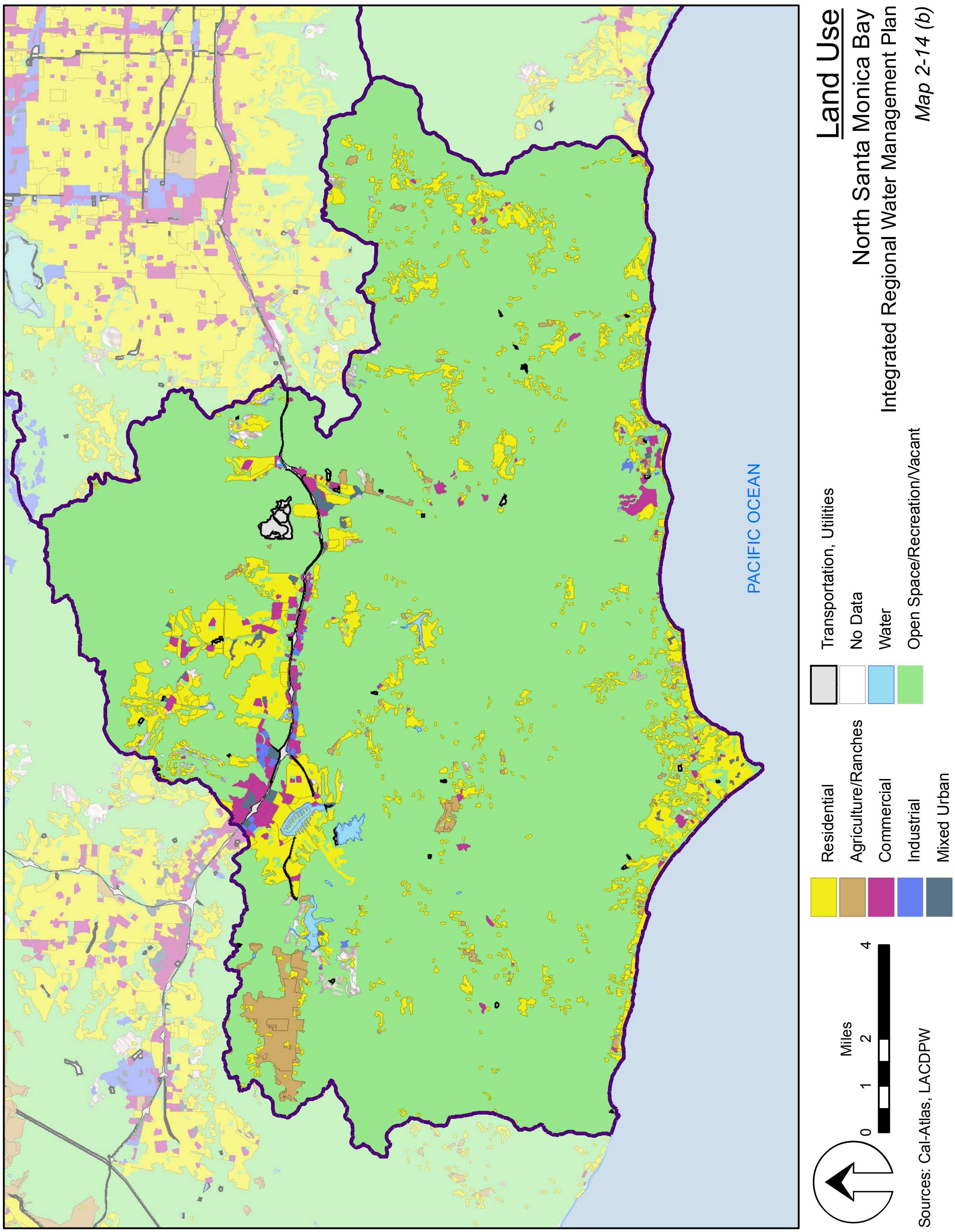
Table 2-6: Land Use (acres)

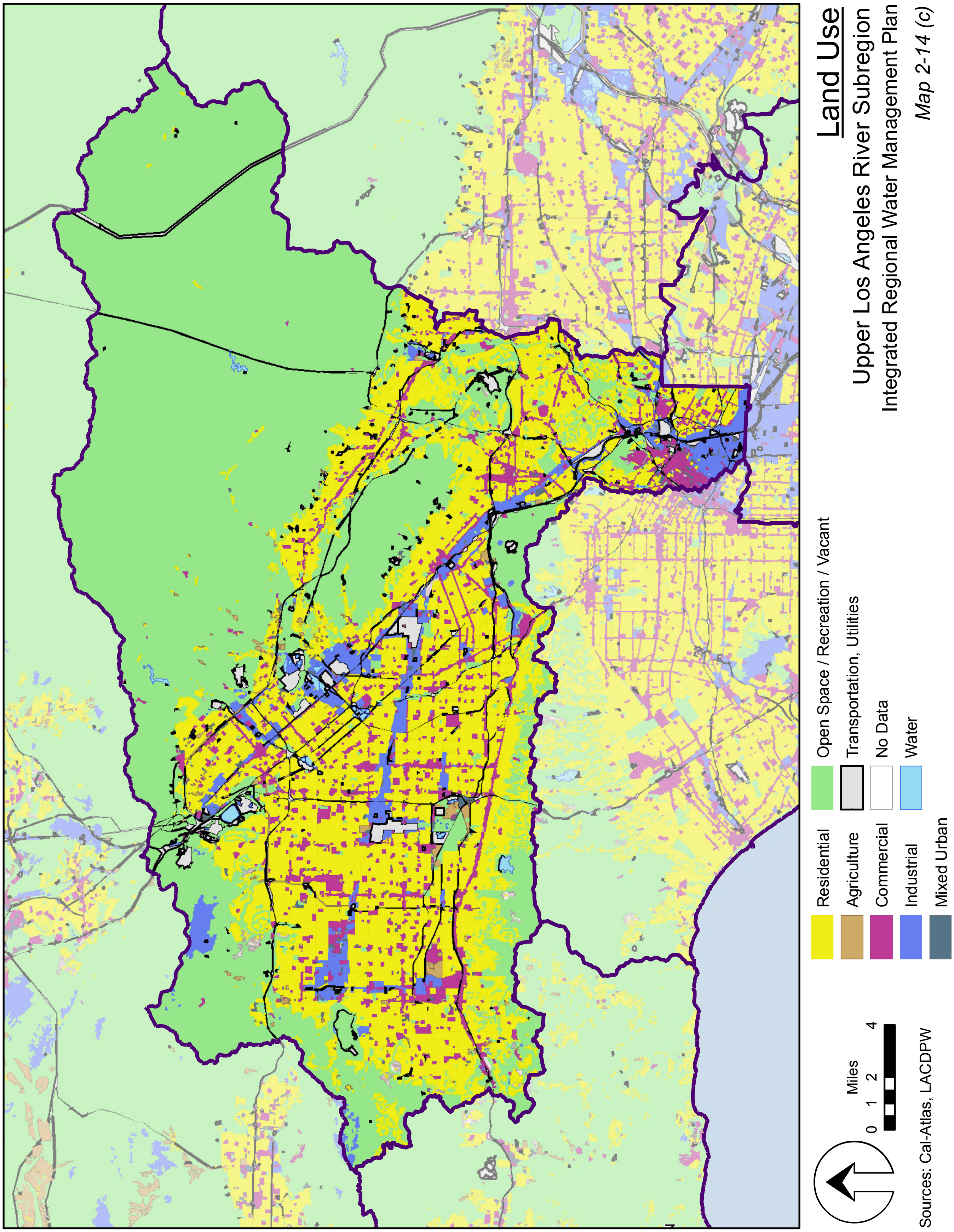
Land Use Category	Lower SG & LA	North Santa Monica Bay	South Bay Subregion	Upper Los Angeles River Subregion	Upper San Gabriel River and Rio Hondo Subregion	Region Totals	Percent
Residential	134,533	14,363	114,045	124,114	100,525	487,580	26.1%
Commercial	36,999	1,941	28,562	21,726	21,569	110,797	5.9%
Industrial	35,602	237	21,702	15,757	12,570	85,868	4.6%
Transportation, Utilities	19,935	1,146	15,073	19,399	12,766	68,319	3.7%
Open Space / Recreation / Vacant	42,778	196,142	56,850	449,515	323,763	1,069,048	57.2%
Agriculture	3,208	2,017	1,090	2,195	3,737	12,247	0.7%
Mixed Urban	221	438	3,271	1,944	3,126	9,000	0.5%
Water	11,148	476	4,073	1,024	2,665	19,386	1.1%
No Data	606	951	748	1,116	2	3,423	0.2%
Totals	**287,880**	**217,710**	**245,416**	**636,791**	**480,723**	**1,868,520**	**100**

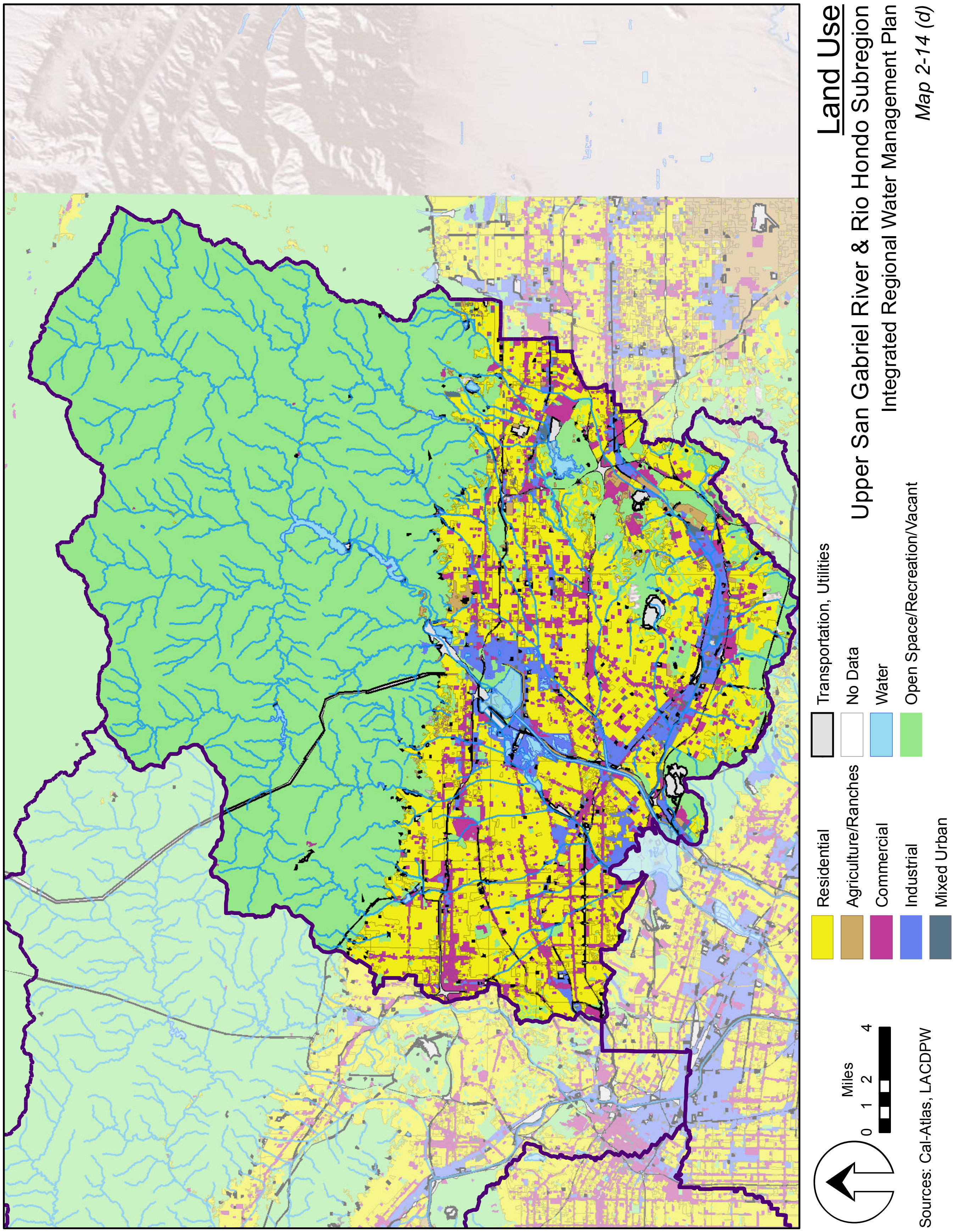
Source: Los Angeles County and Southern California Association of Governments

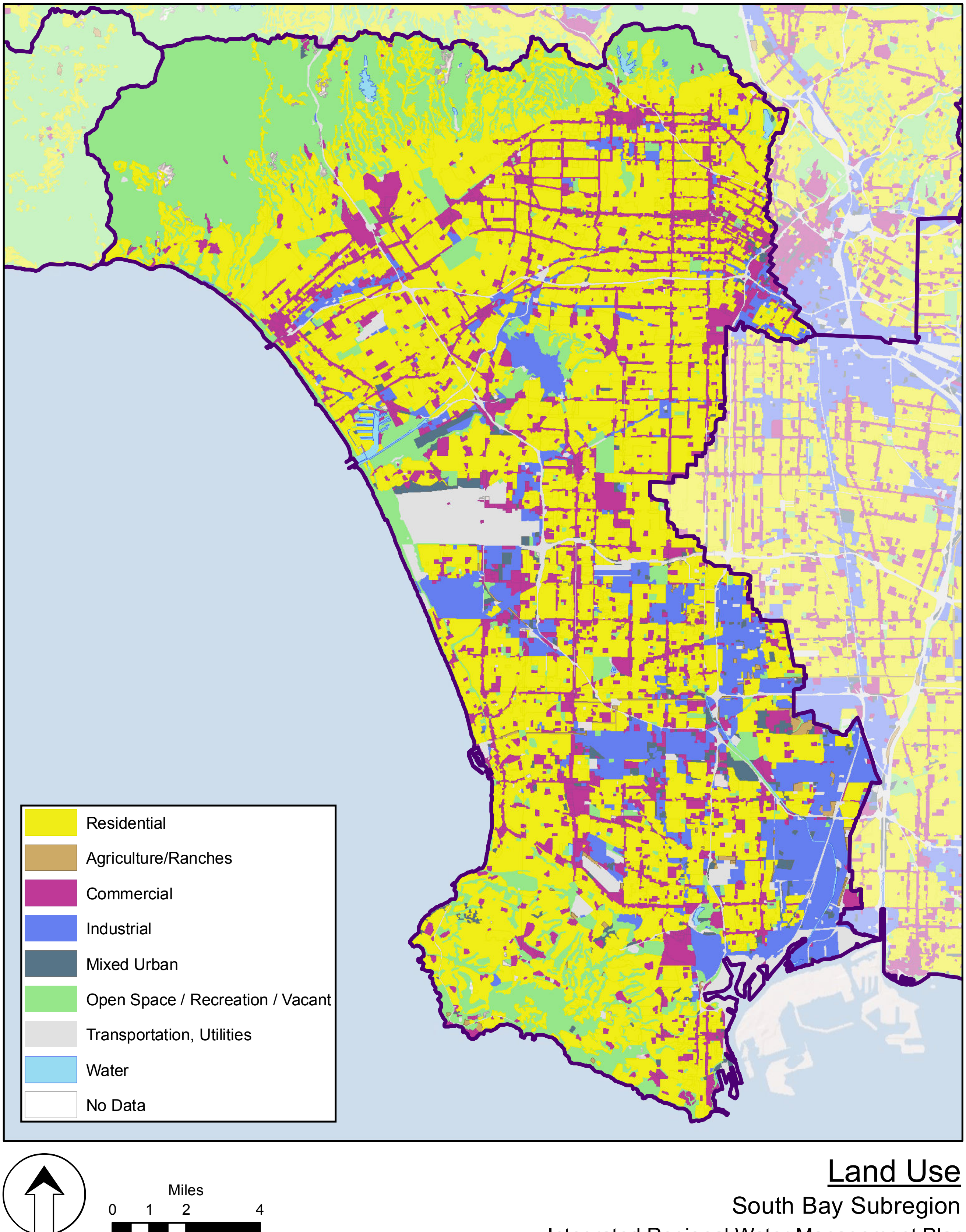


Land Use
Lower San Gabriel & Los Angeles Rivers Subregion
Integrated Regional Water Management Plan
Map 2-14 (a)


Land Use
North Santa Monica Bay
Integrated Regional Water Management Plan
Map 2-14 (b)
PACIFIC OCEAN
Miles
0 1 2 4
Residential
Agriculture/Ranches
Commercial
Industrial
Mixed Urban
Transportation, Utilities
No Data
Water
Open Space/Recreation/Vacant
Sources: Cal-Atlas, LACDPW


Land Use
Upper Los Angeles River Subregion
Integrated Regional Water Management Plan
Map 2-14 (c)
Residential
Agriculture
Commercial
Industrial
Mixed Urban
Open Space / Recreation / Vacant
Transportation, Utilities
No Data
Water
Miles
0 1 2 4
Sources: Cal-Atlas, LACDPW


Land Use
Upper San Gabriel River & Rio Hondo Subregion
Integrated Regional Water Management Plan
Map 2-14 (d)
Residential
Agriculture/Ranches
Commercial
Industrial
Mixed Urban
Transportation, Utilities
No Data
Water
Open Space/Recreation/Vacant
Miles
0 1 2 4
Sources: Cal-Atlas, LACDPW



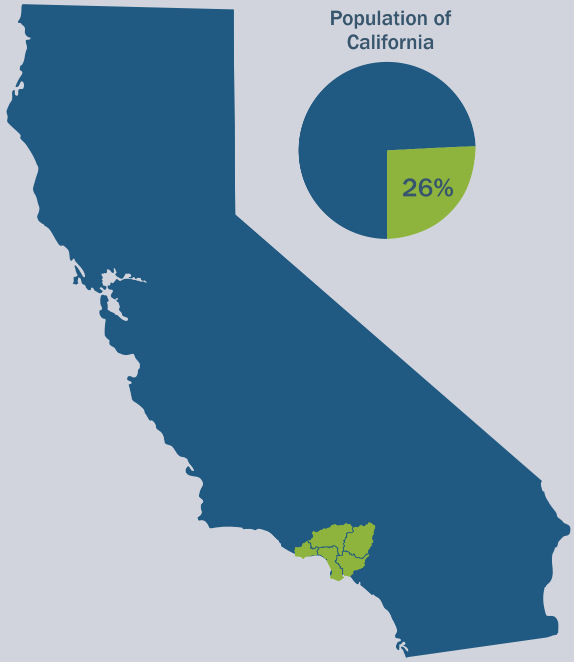
Land Use

South Bay Subregion

Integrated Regional Water Management Plan

Map 2-14 (e)

Sources: Cal-Atlas, LACDPW



Subregion	Population
Lower San Gabriel and Los Angeles Rivers	3,031,347
North Santa Monica Bay	106,687
South Bay	2,694,337
Upper Los Angeles	2,270,314
Upper San Gabriel and Rio Hondo	1,524,271
The Greater Los Angeles County Region Total	9,626,956

Figure 2-1. 2010 estimated Greater Los Angeles County Region population. The Greater Los Angeles County Region represents 26 percent of California's population.

2.12 Social Characteristics

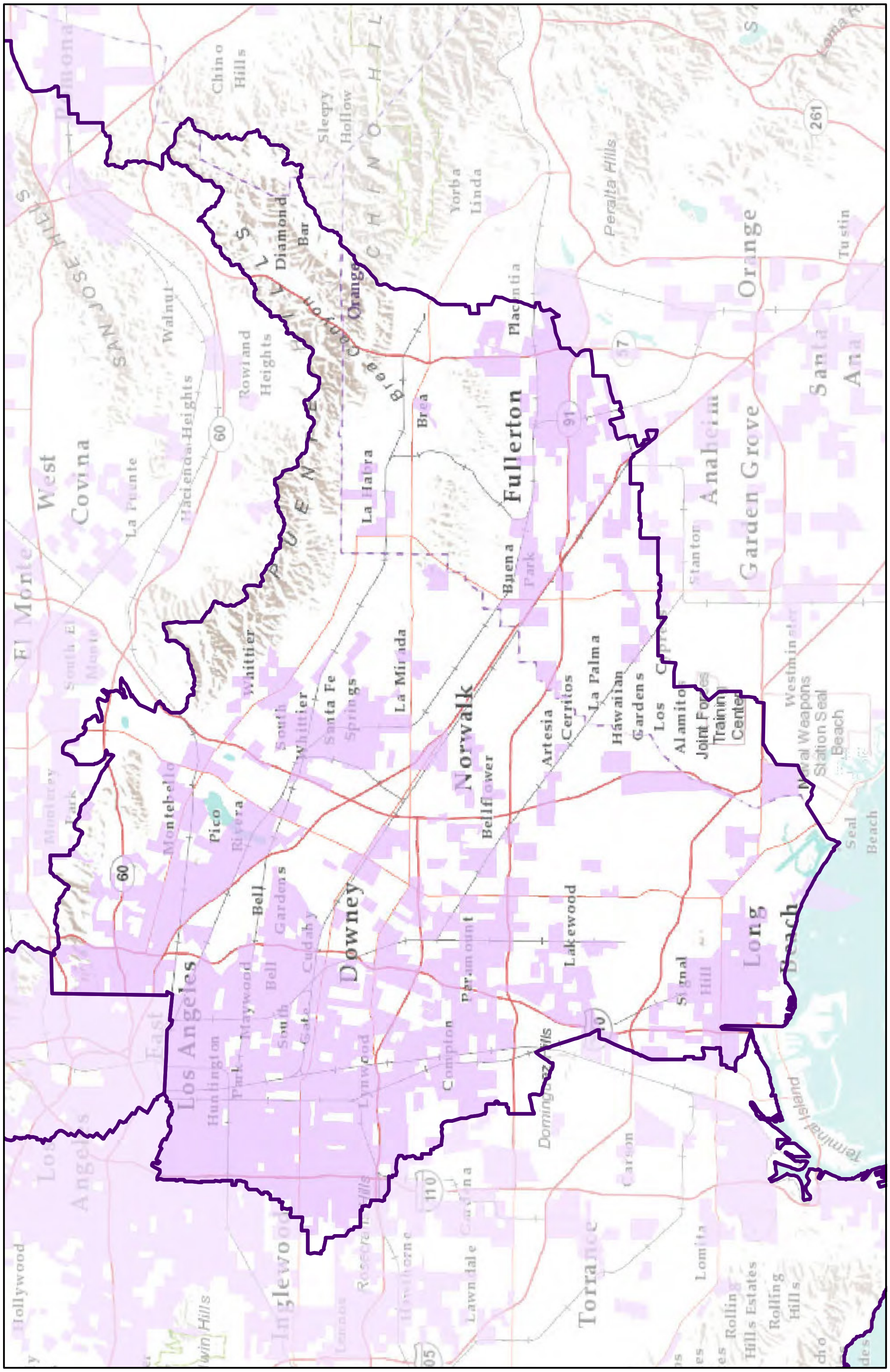
The Region's population is currently estimated at approximately 9.6 million residents as depicted in Figure 2-1, which represents approximately 26 percent of the State's estimated 2010 population of 36.6 million.

Per State Guidelines, DACs are those with an annual median household income (MHI) that is less than 80 percent of the statewide annual median household income (CWC § 79505.5 (a)). Using American Community Survey (ACS) 2006-2010 data, 80 percent of the statewide annual MHI is $48,706. Those communities meeting these criteria are depicted in Map 2-15(A) through 2-15(D). Note that there are no DACs in the North SM Bay Subregion but the area serves as a major recreation resource for over 33 million annual visitors from the GLAC area that include many programs and services for residents living in DACs.

As depicted on these maps, DACs are located throughout much of the Region. As discussed in the sections above, water management issues, such as a reliable water supply, poor surface water quality, and groundwater contamination also occur throughout the Region. The parkland to population ratio tends to be much lower in DACs, where access to park space is as low as 0.8 acres per 1,000 residents. No specific relationship has been identified between the location of DACs and the location of water resource management issues. As discussed in Chapter 1 of this Plan, the GLAC Region contacted the NAHC to determine if the Region was home to any tribes or tribal interests. The response from the NAHC indicated that the Region is not home to any federally-recognized tribes or tribal lands.

2.13 Social Trends and Concerns

The watershed management plans for many of the Region's major watersheds identify various goals, objectives, and guiding principles. Those various concepts are incorporated in this Plan as objectives in Chapter 3, but noted here as a reflection of the social and cultural values of the Region. They include: reduce dependence on imported water, optimize use of local water resources, enhance water supply reliability, improve the quality of urban runoff and stormwater, maintain and enhance flood protection, increase watershed friendly recreation



Subregions
Income defined DAC

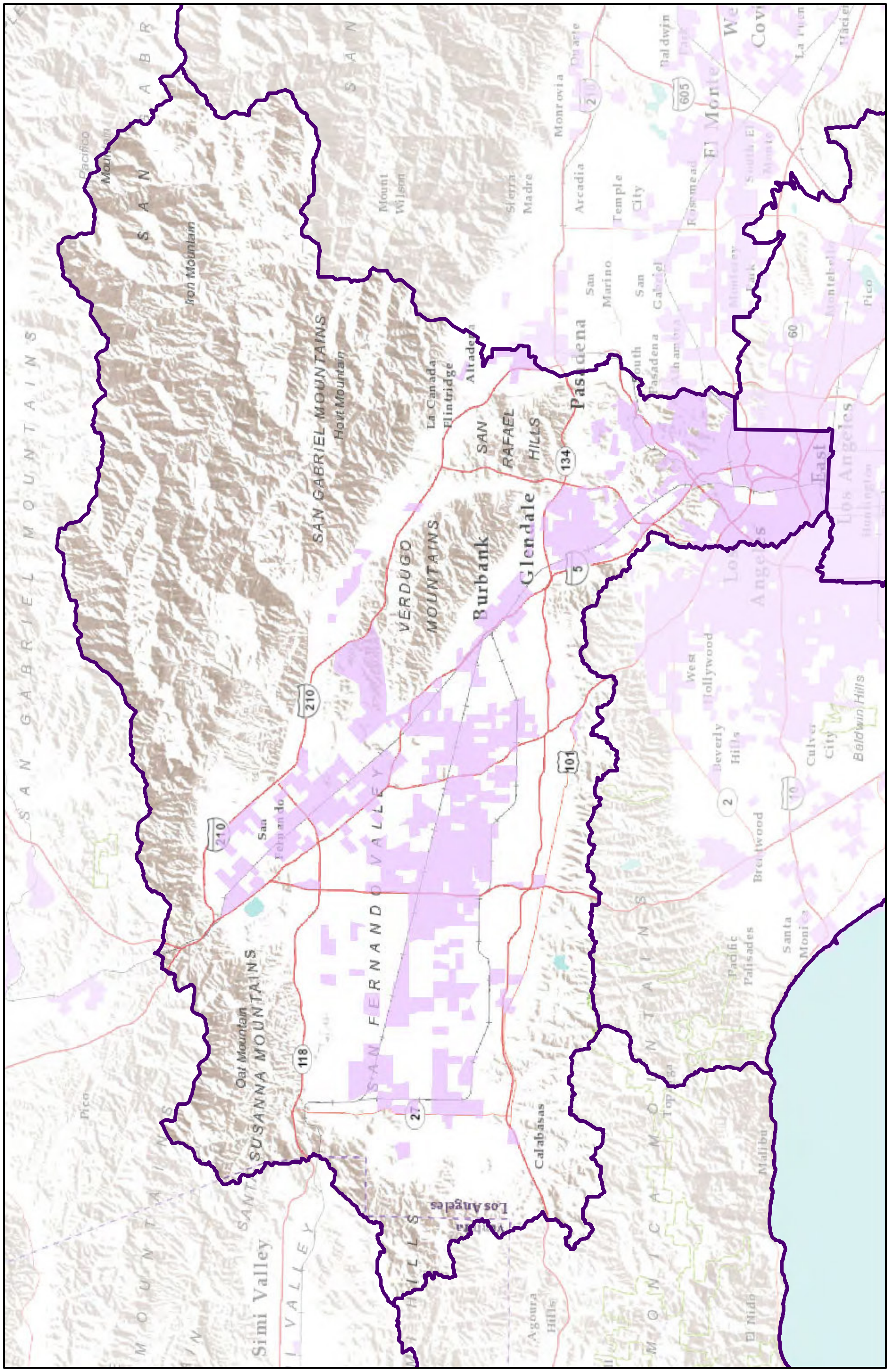
Sources: Cal-Atlas, DWR

Disadvantaged Communities

Lower San Gabriel & Los Angeles Rivers Subregion

Integrated Regional Water Management Plan

Map 2-15 (a)



Subregions

Income defined DAC

Miles

0 1 2 4

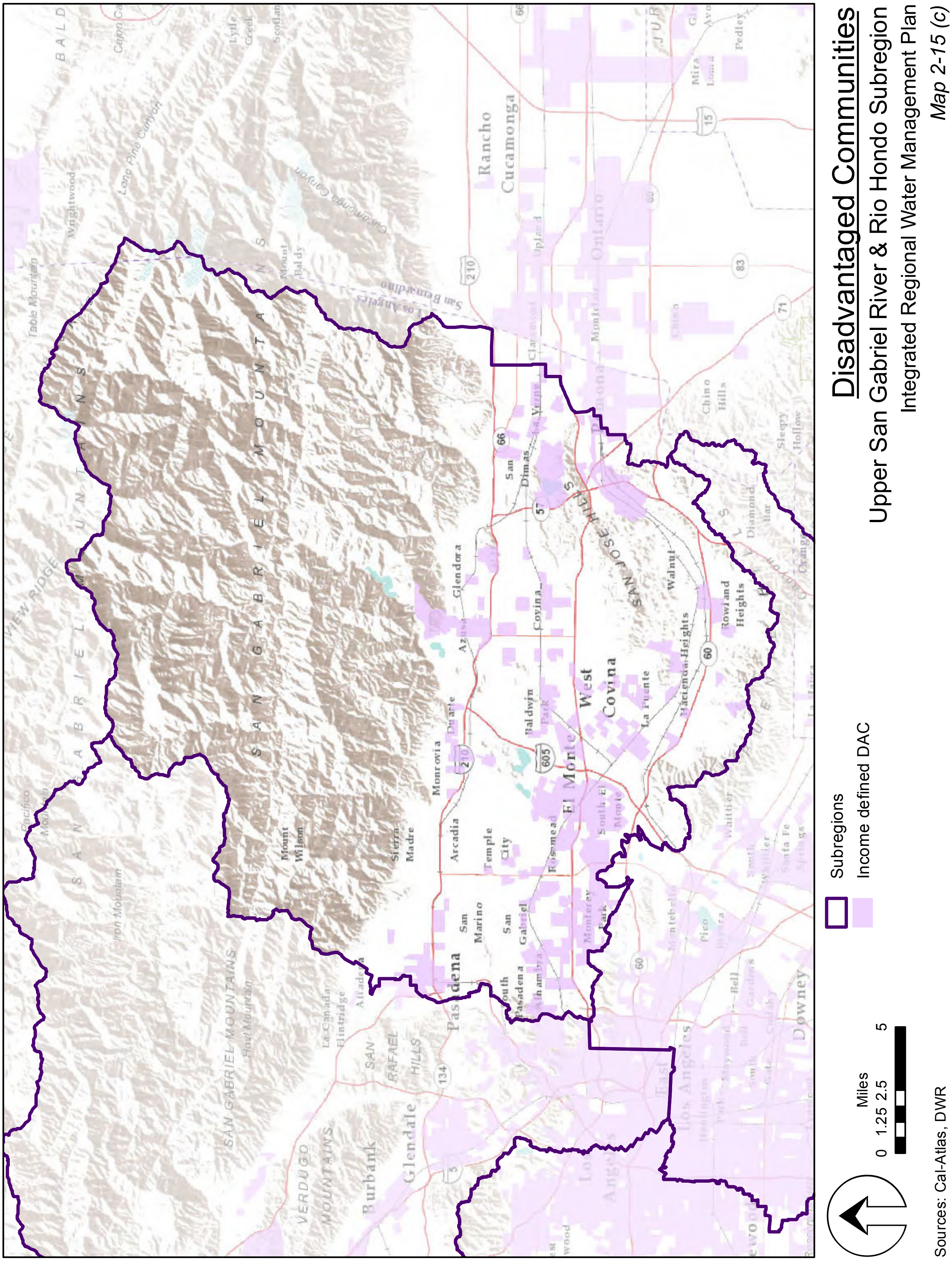
Sources: Cal-Atlas, DWR

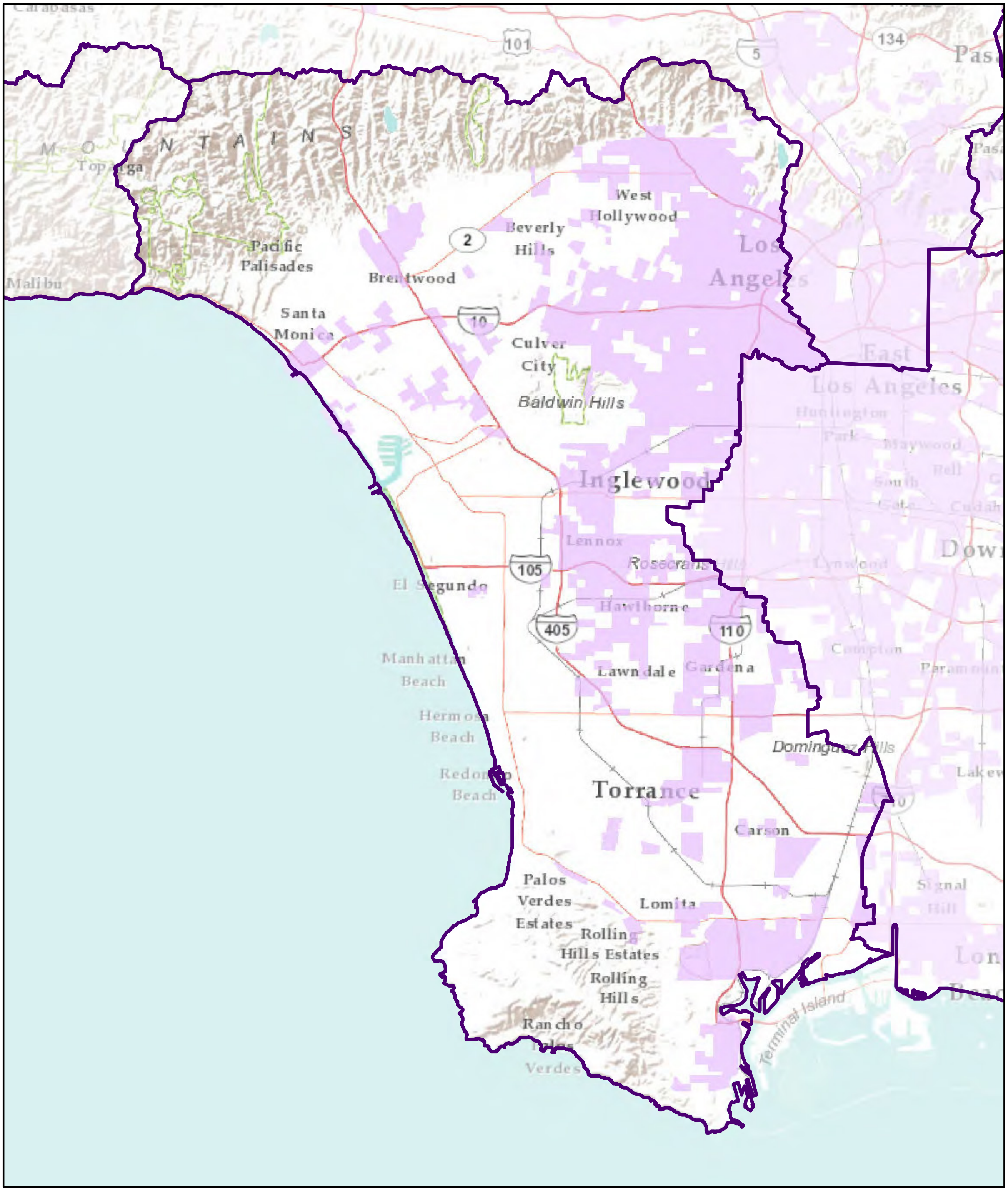
Disadvantaged Communities

Upper Los Angeles Subregion

Integrated Regional Water Management Plan

Map 2-15 (b)


Disadvantaged Communities
Upper San Gabriel River & Rio Hondo Subregion
Integrated Regional Water Management Plan
Map 2-15 (c)
Subregions
Income defined DAC
Miles
0 1.25 2.5 5
Sources: Cal-Atlas, DWR
SAN GABRIEL MOUNTAINS
Mount Wilson
Sierra Madre
Arcadia
Monrovia
Duarte
Azusa
Glendora
San Dimas
La Verne
Claremont
Pomona
Montclair
Upland
Ontario
Rancho Cucamonga
Chino
Chino Hills
Diamond Bar
Walnut
Rowland Heights
Hacienda Heights
La Puente
West Covina
Covina
Baldwin Park
El Monte
South El Monte
Rosemead
Temple City
San Marino
San Gabriel
Alhambra
South Pasadena
Pasadena
Altadena
Monterey Park
Montebello
Pico Rivera
Whittier
Santa Fe Springs
Downey
East Los Angeles
Los Angeles
Glendale
Burbank
La Canada Flintridge
VERDUGO MOUNTAINS
SAN RAFAEL HILLS
SAN JOSE HILLS
Wrightwood
Mount Baldy
Cucamonga Canyon
Lone Pine Canyon
Table Mountain
Los Angeles
San Bernardino



Miles
0 0.75 1.5 3

Subregions
Income defined DAC

Sources: Cal-Atlas, DWR

Disadvantaged Communities

South Bay Subregion

Integrated Regional Water Management Plan

Map 2-15 (d)

and accessible open space for all communities, conserve and restore native habitat, manage public open spaces to reduce the risk of catastrophic wildland fires, and promote the application of watershed approaches to resource management issues.

Census data shows that population growth in the Region is slowing (a three percent increase from 2000-2010, down from a seven percent increase from 1990-2000). The number of households has increased by three percent between 2000 and 2010, and average household size increasing by four percent. Social trends in the Region may be summarized on the basis of certain demographic trends. The Public Policy of California (PPIC)[2] and the Southern California Association of Governments (SCAG)[3] describes trends for portions of California, including Los Angeles, Ventura, and Orange Counties, and is representative of the Region. In the last decade, births represented the largest portion of population increase in the Region, followed by international migration. Domestic migration was a net loss to the population during that period. With the economic downturn, employment decreased over the last ten years, decreasing by approximately 7 percent[4]. Ethnic diversity continues to increase, as the percentage of non-hispanic white residents declines (from 31 percent in 2000 to 28 percent in 2010)[2].

Social concerns in the Region may be reflected by a recent survey of Los Angeles residents (PPIC, 2005), which found that residents are unhappy with some key indicators of quality of life. Large majorities say traffic congestion on freeways and major roads (74 percent) and the availability of affordable housing (64 percent) are big problems in the county today. Majorities of residents still rate police protection (57 percent) and the quality of parks, beaches, and recreation facilities (58 percent) as excellent or good, but their assessments have fallen in recent years. Residents are far less charitable in their rating of other public services: Only one-third give excellent or good ratings to streets and roads (32 percent today, 51 percent in 2004) and public schools (36 percent today, 43 percent in 2004). In contrast, large majorities of residents in neighboring Orange County give excellent or good ratings to police protection (83 percent), recreational facilities (84 percent), streets and roads (64 percent), and public schools (64 percent). Los Angeles County residents are more likely to believe that Los Angeles County will be a worse place (37 percent) rather than a better place (24 percent) to live in 20 years, with 35 percent anticipating that quality of life in the county will stay the same. Fully one-third of county residents (33 percent) expect to leave Los Angeles County in the next five years, up from 17 percent in 2003.

2.14 Climate Change

Climate change projections have shown that California water resources can expect to be impacted by changes to temperature, precipitation, and sea level rise, and even now California is beginning to experience these impacts.

Water resource planners already face challenges interpreting new climate change information and discerning which response methods and approaches will be most appropriate for their planning needs. However, in order for the Region to adapt to, or protect against, climate change, it must first identify the impacts climate change is expected to have on the Region. Knowing these changes will help to identify potential vulnerabilities in water resource systems, which can identify and inform planning measures. Future projects in the Region will be considered for their ability to adapt to the anticipated climate change impacts and mitigate greenhouse gas emissions (GHGs) as described in Chapter 5. These actions will help the GLAC Region be more robust in the face of a changing environment.

On a state-wide level, these impacts are expected to impact local water resources as follows (DWR, 2011):

- Temperature increases:
    - More winter precipitation falling as rain rather than snow, leading to reduced snowpack water storage, reduced long term soil humidity, reduced groundwater and downstream flows, and reduced imported water deliveries

2. PPIC, 2012. Key Stats – Population Size and Growth. Components of Population Growth. http://www.ppic.org/main/keystat.asp?i=1261
3. SCAG, 2011. Local Profiles of SCAG Jurisdictions. http://www.scag.ca.gov/resources/profiles.htm
4. Bureau of Labor Statistics, 2000-2010. May 2000 and May 2010 Occupational Employment and Wage Estimates. Metropolitan Area Cross-Industry Estimates.

  - Higher irrigation demands as temperatures alter evapotranspiration rates, and growing seasons become longer
  - Exacerbated water quality issues associated with dissolved oxygen levels, increased algal blooms, and increased concentrations of salinity and other constituents
  - Impacted habitats for temperature-sensitive fish and other life forms, and increased susceptibility of aquatic habitats to eutrophication
- Precipitation pattern changes:
  - Increased flooding (both coastal and inland) caused by more intense storms
  - Changes to growth and life cycle patterns caused by shifting weather patterns
  - Threats to soil permeability, adding to increased flood threat and decreased water availability
  - Reduced water supply caused by the inability to capture precipitation from more intense storms, and a projected progressive reduction in average annual runoff (though some models suggest that there may be some offset from tropical moisture patterns increasingly moving northward)
  - Increased turbidity caused by more extreme storm events, leading to increased water treatment needs and impacts to habitat
  - Increased wildfires with less frequent, but more intense rainfall, and possibly differently timed rainfall through the year, potentially resulting in vegetation cover changes
  - Reduction in hydropower generation potential
- Sea level rise:
  - Inundation and erosion of coastal areas (coastal bluffs in particular), including coastal infrastructure
  - Saline intrusion of coastal aquifers
  - Increased risk of storm surges and coastal-flooding and erosion during and after storms
  - Changes in near-shore protective biogeography such as loss of sand, tide pools, wetlands, and kelp beds

Although the extent of these changes is uncertain, scientists agree that some level of change is inevitable; therefore, it will be necessary to implement flexible adaptation measures that will allow natural and human systems to respond to these climate change impacts in timely and effective ways. In addition to adapting to climate change, the Region has the opportunity to mitigate against climate change by minimizing GHGs associated with provision of water and wastewater services. The following is a discussion of likely climate change impacts on the Region, as determined from a vulnerability assessment. Opportunities for adapting to and mitigating against climate change will be discussed in later chapters of this Plan.

Effects of Climate Change on the GLAC Region

Estimating the impacts of climate change at a regional level is challenging due to the coarse spatial scale of the global models that project climate change impacts of temperature and rainfall. These global models also project estimates for the year 2100, which is well beyond typical planning horizons of 20 to 30 years. To incorporate climate change into water resources management, downscaled temperature and precipitation projections are input into hydrologic and water resources system models to project impacts to water supplies, water demand, snow pack, sea level rise, and wildfires.

The need for and interest in more refined geographic and temporal scale climate change models has precipitated two recent climate change analysis efforts within the GLAC Region.

Climate Change in the Los Angeles Region: A modeling effort being led by UCLA for a partnership of the Los Angeles Regional Collaborative for Climate Action and Sustainability and the City of Los Angeles to refine climate modeling for the Greater Los Angeles area between 2041 to 2060. The results of the temperature modeling have already been released and have been incorporated into the climate change effects described here. The modeling effort will also produce precipitation, hydrology, cloud cover, wind and sea level rise impacts – however the results of these analyses were not yet available for this section.

Los Angeles Basin Stormwater Conservation Study: A partnership between the US Bureau of Reclamation and the LACFCD to refine climate change projections influenced by localized geographic differences between coastal and inland areas, as well as changes in topography. Resulting climate projections will be simulated in existing LACFCD facilities and hydrologic models to identify potential flooding and supply effects and vulnerabilities. Since the effort was begun in February 2013, the results were not yet available for use in this 2013 Plan Update.

Regional Climate Change Impacts

Climate change impacts and effects are based on different climate change assumptions and analysis approaches. Table 2-7 summarizes the impacts and effects of climate change on the GLAC Region by 2100 (unless otherwise indicated), which are typically based on an average of various climate change analyses. However, only temperature projections are available at a refined scale for the GLAC Region as shown in Table 2-7.

Climate change is expected to increase average temperature by at least 3.5 degrees Fahrenheit by mid-century with the number of hot days (with temperatures greater than 95° F) tripling at the coast. This effect is further exacerbated in the inland areas. Precipitation is expected to decrease by at 2 to 5 inches throughout the South Coast of California with the most extreme reductions taking place in the higher elevations. These temperature effects are presented in Figures 2-2 and 2-3 from the UCLA climate change modeling effort.

Recent sea level rise studies have estimated an average 11 inch rise along coastal areas in Southern California. The three major imported water supplies feeding the Region are also anticipating delivery decreases as a result of climate change.

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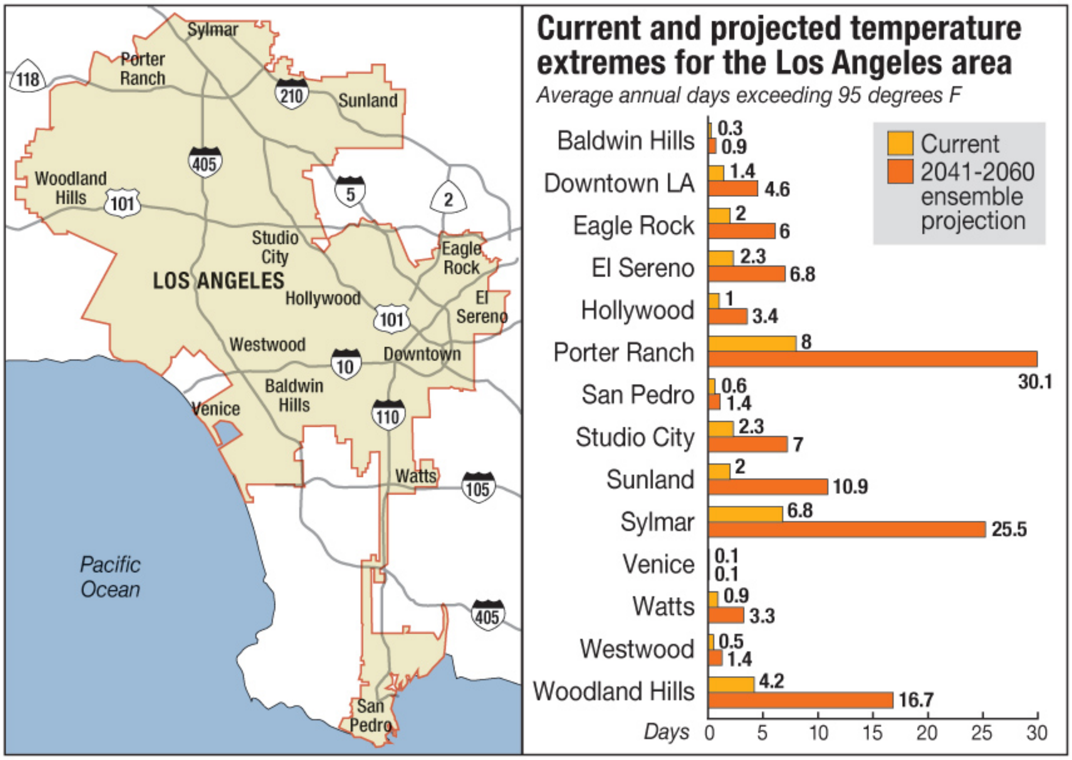
Table 2-7: Impacts and Effects of Climate Change on Region

Impact to	Effect
Temperature change[1]	• Coastal LA Basin: Increases of 3.5 to 4°F (2041-2060) • Inland LA Basin: Projected increases of 4 to 4.5°F (2041-2060) • Extreme hot days: Number will triple in coastal areas and central Los Angeles, quadruple in San Fernando and San Gabriel Valleys (2041-2060)
Precipitation[2]	• Low-lying Southern California coastal areas: 2 inch decrease in average rainfall • Higher Southern California elevations: 4 to 5 inch decrease in average rainfall
Wildfire Risk[2]	• Little change is projected – already high fire risk
Sea Level Rise[3]	• Rise of 11 inches by 2050 (Southern California)
Demand	• Increases expected, but not quantified

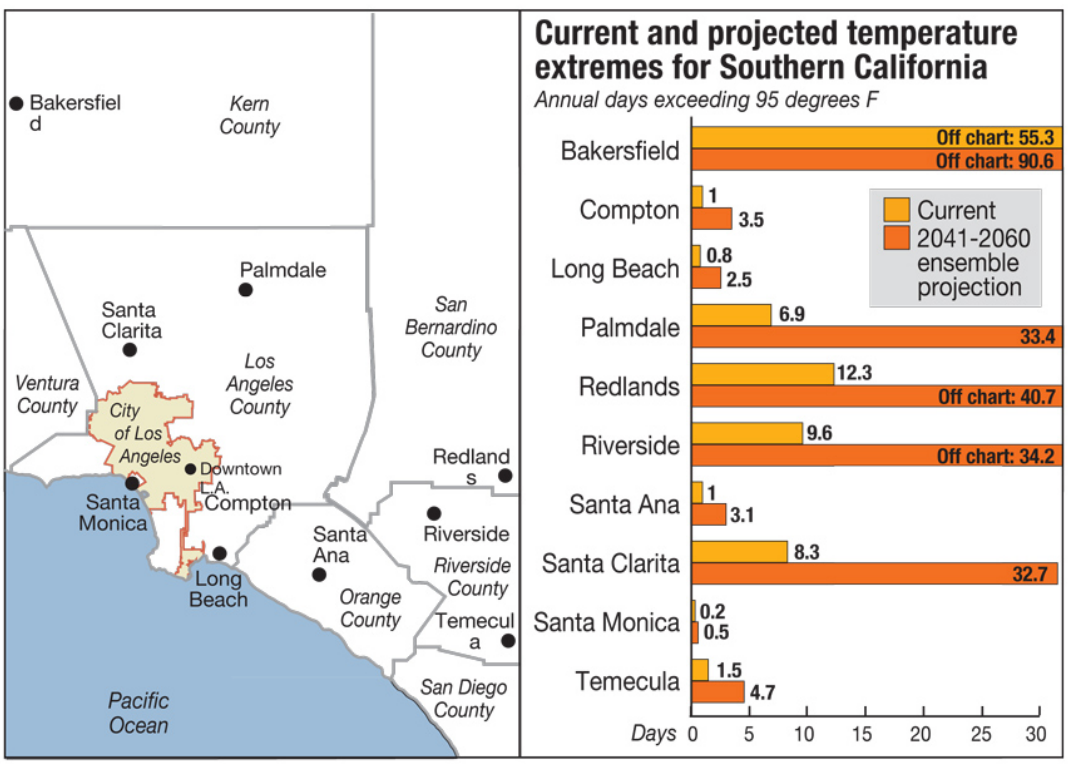
Supply	• **State Water Project[4]**: delivery decrease of 7-10% by 2050
	• **Colorado River[5]**:
	  • Flows to decrease by 7-9% by 2050
	  • Shortages to Lower Basin of:
	  • 1 MAF over any 2 year window up to 51% of the time
	  • 1.5 MAF over any 5 year window up to 59% of the time
	• **Los Angeles River Aqueduct[6]**: Deliveries to decrease by 10,000 AFY
	Local groundwater and local river flow impacts not available

1. Climate Change in the Los Angeles Region Project: Mid-Century Warming in the Los Angeles Region (UCLA, 2012)
2. California Climate Change Adaptation Planning Guide (CA Emergency Management & Natural Resources Agencies, 2012)
3. Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future (NRC, 2012)
4. Using Future Climate Projections to Support Water Resources Decision Making in California (Climate Change Center, 2009)
5. Colorado River Basin Water Supply and Demand Study Final Reports (USBR 2012)
6. City of Los Angeles 2010 Urban Water Management Plan (LADWP, 2011)



Source: UCLA LARC study, 2012; chart based on the mean/average projected by the 19 climate models

Figure 2-2: Current and Projected Temperature Extremes for City of Los Angeles Communities



Source: UCLA LARC study, 2012; chart based on the mean/average projected by the 19 climate models

Figure 2-3: Current and Projected Temperature Extremes for Southern California

Climate Change Impacts to DACs

Climate Change effects can present even greater potential impacts to the Region's DACs. DACs are, by their definition, resource limited which impacts their ability to meet current water management needs that would be further exacerbated by climate change. Of particular concern is increased flooding that could result from both sea level rise in coastal DACs like the Wilmington area and from flashier precipitation events in inland DAC areas like Sun Valley (OPC, 2011). DAC residents are also less likely to be able to afford relocation as a way to respond to sea level rise and flooding impacts.

Identification of Vulnerabilities

Understanding the potential impacts and effects that climate change is projected to have on the Region allows an informed vulnerability assessment to be conducted for the Region's water resources. A climate change vulnerability assessment helps a Region to assess its water resource sensitivity to climate change, prioritize climate change vulnerabilities, and ultimately guides decisions as to what strategies and projects would most effectively adapt to and mitigate against climate change. DWR has recommended IRWM Regions use the Climate Change Handbook for Regional Planning (developed by USEPA, DWR, Army Corps, and the Resource Legacy fund) as a resource for methodologies to determine and prioritize regional vulnerabilities. The Climate Change Handbook provided specific questions that helped to identify key indicators of potential vulnerability, including:

- Currently observable climate change impacts (climate sensitivity)
- Presence of particularly climate sensitive features, such as specific habitats and flood control infrastructure (internal exposure)
- Resiliency of a region's resources (adaptive capacity)

The Climate Change Subcommittee conducted an exercise to answer vulnerability questions taken from Box 4-1 of the Climate Change Handbook and associated the answers with potential water management issues/vulnerabilities. See Appendix O for a summary of the analysis. Included in this analysis are qualitative vulnerability questions framed to help assess resource sensitivity to climate change and prioritization of climate change vulnerabilities within a region. Answers to vulnerability questions are given for the GLAC Region with local examples provided as justification for the answer. Vulnerability issues are prioritized in the next section.

Prioritization of Vulnerabilities

The vulnerability issues identified in the climate change analysis discussed above were reviewed by the group, and some of the language was refined to better articulate the vulnerability issues of the Region. Those vulnerability issues were then prioritized into three tiers relative to each other and based upon the perceived risk and importance of the issue. Those vulnerabilities posing the greatest risk of occurrence and resulting in the greatest impacts upon occurrence were ranked as the highest priority.

The list of prioritized vulnerabilities developed by the Workgroup is shown in Table 2-8, and discussed further below. Note that the vulnerability issues shown in Appendix O do not necessarily exactly match those in Table 2-8 since refinements and edits were made to the vulnerabilities during the prioritization process.

The justification as to why the following vulnerability issues were classified as high priority is provided below:

- **Decreased ability to meet conservation goals:** There is concern that it will be very difficult for the Region to reach the state goal of a 20 percent reduction in per capita potable water use by 2020. In addition, demand hardening will reduce the water use efficiency options available to make further reductions in use beyond the current goal of 20 percent. Although conservation programs reduce the amount of water needed by customers, long-term conservation programs have not generated overall cost savings to those customers. Water supply agencies must still maintain and operate supply facilities so decreased revenues as a result of conservation must be balanced through rate adjustments. Increased costs to customers could discourage them from continuing water conservation.

Table 2-8: Prioritized Climate Change Vulnerability Issues	
Level	**Vulnerability Issue**
High	• Decreased ability to meet water conservation goals • Reduced resiliency to drought • Municipal water demand would increase • Decrease in imported water supply (from impacts to Bay-Delta system) • Decrease in coastal groundwater supply • Increase in wildfire risk and erosion and sedimentation which may impact water quality, flood control, and habitat • Damage to coastal infrastructure/recreation/tourism due to sea level rise and storm surge
Medium	• Invasives can reduce water supply available, alter flood regimes, and alter wildfire regimes • Decrease in local surface water supply • Decrease in seasonal water reliability • Increase in nutrient loading and decreased Dissolved Oxygen • Decrease in dilution flows • Decrease in recreational opportunity • Increase in source control or surface water treatment • Decrease in land due to SLR • Increased impacts to habitat and flow availability for species
Low	• Agricultural water demand would decrease • Limited ability to meet higher peaks in water demand (both seasonally and annually) • Habitat water demand would increase • Damage to ecosystem/habitat due to sea level rise • Increases in inland and flash flooding • Decrease in habitat protection against coastal storms • Decrease in hydropower potential

- **Reduced resiliency to drought:** The Region is highly vulnerable to persistent drought and the projected climate change effects will only increase the potential for drought and therefore the need for resiliency.
- **Municipal demand would increase:** The inland areas of the Region are projected to have the most growth because of lower housing costs and more area to be developed. These inland areas will also show the greatest increases in temperature, which will increase water demand and the likelihood of drought. Supply development projects to meet these demands will take time to develop and implement.
- **Decrease in imported supply:** The Region is heavily dependent upon imported water supplies which are very susceptible to the impacts of climate change given their reliance on seasonal snowpack. The Region could not be solely dependent upon local resources to sustain the current economy, so imported water must be secured. Much of the supply is also highly vulnerable at its source, given the dependence upon the stability of the San Francisco Bay Delta levee system and ecological condition. Climate change impacts to this area from higher sea level rise and higher storm surges and increased salinity could be catastrophic to the supply.
- **Decrease in groundwater supply:** Imported and other local supplies (like surface and recycled water) are necessary to sustain the current levels of groundwater replenishment needed to meet groundwater pumping adjudication levels. If overall surface supplies are less available due to climate change impacts, then replenishment supplies would be jeopardized. Furthermore, coastal groundwater supplies are susceptible to salinity intrusion, which would be exacerbated by sea level rise.

- **Increased wildfire risk and erosion and sedimentation which may impact water quality, flood control, and habitat:** Increases in erosion from increased wildfires and flashier storm events would result in increased sediment loads entering local streams. Many of the Region's local streams have flood control facilities that serve to not only protect from flood events but are also used to capture and recharge storm flows into the groundwater basins for both supply and water quality objectives. Increased sediment loads would impact the ability of these facilities to provide either of those functions
- **Damage to coastal infrastructure/recreation/tourism due to sea level rise and storm surge:** Coastal infrastructure is vulnerable because of the combined effects of sea level rise and increased flooding from climate change. Current populations are higher along coast areas and so dependency on these facilities is greater. However, relocation of facilities will be expensive and challenging given limited open space and land availability. Recreation and tourism will be greatly impacted from potential increases in beach closures.

Climate Change Reporting and Registry Coordination

Individual agencies within the GLAC IRWM may individually decide whether to participate in the California Adaptation Strategy Process as part of further integrating the information derived from the local climate change studies being conducted and described above.

Agencies that are part of the GLAC IRWM effort may consider joining the Climate Registry, http://www.theclimateregistry.org. The Climate Registry serves as a voluntary GHG emissions registry that developed tools and consistent reporting formats which may aid agencies in understanding their GHG emissions and ways to promote early actions to reduce GHG emissions. Both the State and the federal government require reporting of emissions for regulated entities of electricity and fuel use. These programs have reporting, certifying and verifying requirements that are separate from those under the voluntary programs.