Executive Summary

Groundwater Assessment Study

A Status Report on the Use of Groundwater
in the Service Area of the
Metropolitan Water District of Southern California

Report Number 1308

September 2007

MWD

Metropolitan Water District of Southern California

EXECUTIVE SUMMARY
GROUNDWATER ASSESSMENT STUDY
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
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INTRODUCTION

Groundwater, one of the essential local water supplies in Metropolitan's 5,200 square mile service area, supports nearly 40 percent of the total annual water needs. Between 1995 and 2004, an average of 1.56 million AF of water per year was produced from the groundwater basins in the service area. A map showing groundwater basins within the Metropolitan service area is provided in **Plate ES-1**.

In addition, groundwater represents an important element of Metropolitan's Integrated Resource Plan, or IRP, which has a target of 275,000 AF of dry-year yield from groundwater basins by 2010 and 300,000 AF by 2020 from within the service area. Since this IRP planning process requires planning for three consecutive dry years, the actual planned targets for dry-year storage are 825,000 AF by 2010 and 900,000 by 2020.

This Groundwater Assessment Study documents the state of the groundwater within Metropolitan's service area and provides the technical information needed to support future policy discussions and strategic planning about increasing water supply reliability.

The report includes assessments of:

- Basin management
- Existing facilities and operations
- Historical production, recharge, and water levels
- Water quality
- Groundwater storage opportunities.

TIMELINE

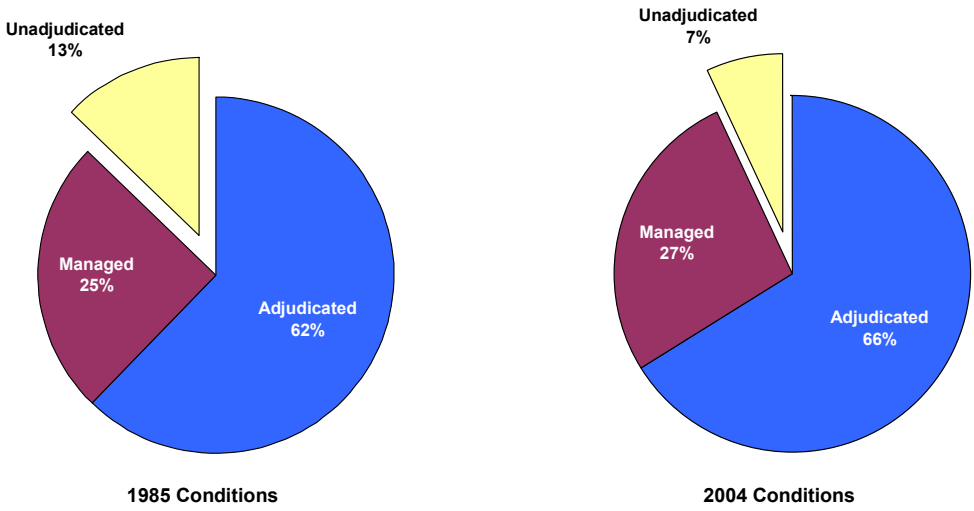
Prepared at the request of Metropolitan's Board of Directors, this study began in December 2005 with a workshop attended by member agency representatives and basin managers. Chapters from the first draft report were released in November 2006, revised, and the full draft report was released in April 2007. The final report was presented to Metropolitan's Board in September 2007.

The report covers the time span of 1985 to 2004. "Current" information reflects conditions as of June 30, 2006.

MANAGING GROUNDWATER BASINS

Groundwater basins within the Metropolitan service area are highly managed. In 2004, 93 percent of the groundwater resources were produced from adjudicated or formally managed (pursuant to an adopted groundwater management plan or State statute) basins. Much of the balance of the groundwater in the Metropolitan service area is currently moving toward adjudication or formal management.

Groundwater Production Classified by Basin Management Type



BASIN OPERATIONS AND MANAGEMENT

The total developed groundwater capacity in Metropolitan's service area currently includes:

- More than 4,300 active production wells (municipal, agricultural, industrial, and private)
- 36 ASR (Aquifer Storage Recovery) wells
- Approximately 5,000 acres of spreading basins
- 400 acres of water quality wetlands to improve quality of inflows to groundwater
- 7 seawater intrusion barriers
- 16 desalters

Groundwater Production

Groundwater production (as opposed to groundwater storage) generally increases during periods of low precipitation and decreases during periods of high precipitation. Groundwater production varies as much 30 percent between the wettest and driest years. In other words, stored water is withdrawn from groundwater basins to make up for declines in the availability of local surface water supplies.

Facilities in the Metropolitan Service Area by Sub-Region

Sub-Region	Active Wells	ASR Injection Wells	Spreading Basins (acres)	Water Quality Wetlands (acres)	Seawater Barriers	Desalters
Northwest Service Area	611	19	220	0	0	1
San Fernando Valley	146	0	314	0	0	0
San Gabriel Valley	414	7	1930	0	0	0
Los Angeles Coastal Plain	1,382	4	1,006	0	3[1]	3
Orange County	500	0	1,034	400	1[1]	3
Inland Empire	773	2	350	0	0	2
Eastside Service Area	453	4	53	0	0	5
San Diego County	85[3]	0	65	0	3[2]	2
Total	**4,364**	**36**	**4,972**	**400**	**7**	**16**

1. Alamitos Barrier Project is attributed to the Los Angeles Coastal Plain Region
2. Wastewater effluent from Camp Pendleton is spread to create seawater intrusion barriers in San Mateo and San Onofre Basins and injected in the Las Flores Basin
3. Data for several basins in San Diego are incomplete.

With the exception of the Northwest Service Area, average groundwater production rose between 1985 and 2004, as shown in this table:

Groundwater Production in the Metropolitan Service Area by Sub-Region

Sub-Region	Average 1985-1994 (AFY)	Average 1995-2004 (AFY)	Percent Change 1985-94 to 1995-04
Northwest Service Area	152,000	122,200	-20%
San Fernando Valley	90,000	109,000	21%
San Gabriel Valley	297,000	320,000	8%
Los Angeles Coastal Plain	241,000	248,000	3%
Orange County	275,000	318,000	16%
Inland Empire	164,000	181,000	10%
Eastside Service Area	181,000	213,000	18%
San Diego County	51,000	52,000	3%
Total	**1,451,000**	**1,563,000**	**8%**

Plate ES-2 shows trends in average annual groundwater production by sub-region.

Active Groundwater Recharge

Active groundwater recharge means artificial recharge using local, imported and recycled waters exclusive of natural recharge. The following table summarizes the active recharge in the Metropolitan service area by region. For this 20-year study period, about 90 percent of the recharge water – approximately 681,000 AFY – was from direct recharge methods: injection or spreading. The remaining 10 percent – about 77,000 AFY – was recharged to the groundwater basins via in-lieu methods. In-lieu recharge is the practice of using alternate source of supply (e.g. imported water) in place of groundwater, thereby leaving groundwater in storage for later use. When supplies are available, Metropolitan financially encourages groundwater producers, through its various in-lieu programs, to turn off their pumping facilities and use imported water from Metropolitan to meet their demands.

In addition, when comparing recharge during the periods 1985-1994 and 1995-2004, the proportion of imported water used for recharge declined 5 percent and spreading of local runoff increased 7 percent. **Plate ES-3** shows trends in active groundwater recharge during wet years. An overall comparison of groundwater production with active recharge for the Metropolitan service area for the 20-year study period shows an average annual 8 percent growth in production with a 2 percent decline in active recharge.

Active Groundwater Recharge in Metropolitan Service Area by Sub-Region

Sub-Region	Average 1985-1994 (AFY)	Average 1995-2004 (AFY)	Change 1985-94 to 1995-04 (%)
Northwest Service Area	57,000	64,000	13%
San Fernando Valley	28,000	34,000	20%
San Gabriel Valley	168,000	170,000	2%
Los Angeles Coastal Plain	221,000	170,000	-23%
Orange County	243,000	271,000	11%
Inland Empire	28,000	18,000	-36%
Eastside Service Area	22,000	23,000	4%
San Diego County [1]	0	0	0%
Total	**767,000**	**750,000**	**-2%**

[1] Recharge data for San Diego County not available.

Trends in Groundwater Levels

Throughout the Metropolitan service area, trends in groundwater levels are highly variable. Groundwater levels in some basins are rising while others are decreasing. In addition, levels in portions of some basins are rising, while other portions of the same basin are decreasing or remaining stable. The five general patterns of water level trends are:

- basins in slow decline
- basins in arrested decline and recovery
- basins with stable, flat water levels (i.e. minor changes with time)
- basins with stable average water levels but with wide swings
- basins with rising water levels, often due to poor water quality and declining use

Groundwater Storage and Water Level Changes

Sub-region	Status
Northwest Metropolitan Service Area	
Ventura County Basins	Arrested decline and recovery
San Fernando Valley	
San Fernando	Long-term decline
Sylmar	Rising
Verdugo	Long-term decline
Eagle Rock	Insufficient Data
San Gabriel Valley	
Raymond	Long-term decline
Main San Gabriel	Stable with wide swings
Puente	Stable with flat water levels
Six Basins	Rising
Los Angeles Coastal Plain	
Central	Stable with flat water levels
West Coast	Stable with flat water levels
Hollywood	Stable with flat water levels
Santa Monica	Rising

Sub-region	Status
Orange County	
Orange County	Stable with wide swings
San Juan	Insufficient data
Inland Empire	
Chino	Stable with flat water levels
Cucamonga	Long-term decline
Eastside Metropolitan Service Area	
Riverside	Stable/decreasing
Arlington	Stable with flat water levels
Temescal Valley	Long-term decline
Elsinore	Long-term decline
West San Jacinto	Rising
Hemet-San Jacinto	Long-term decline
Temecula-Murrieta	Long-term decline
San Diego County	
Various	Insufficient data

The groundwater level trends are shown on **Plate ES-4**. A number of the groundwater basins in the service area are experiencing declining water levels. However, in 2006 only about 15 percent of the total groundwater production came from declining basins. Over two-thirds of the total groundwater production is from the larger basins with stable groundwater levels. As discussed above, total production has increased by over 100,000 acre-feet per year since 1985 and has grown more quickly than active recharge of the groundwater basins. In part, this increase in production appears to have been supported through recharge from previous years. The amount of groundwater that is pumped and treated has also increased in many areas. In general, 2004 groundwater levels are stable, in recovery or increasing. However, maintenance of this growth in production will require increased efforts for recharge in the future.

Groundwater Quality and Treatment

Overall, groundwater quality is good throughout the region. However, there are water quality issues affecting a portion of the groundwater resource. High nitrate and TDS concentrations occur in portions of many groundwater basins throughout the service area. Sources include fertilizers, dairies, septic systems, seawater intrusion, and natural occurrences. Water blending practices, along with seawater barriers and the number of desalters, provide evidence of the need for careful management. Other recurring water quality concerns in some basins include volatile organic compounds (VOCs), naturally occurring iron and manganese, perchlorate, hexavalent chromium, sulfate, and methyl tert-butyl ether (MTBE).

Protecting and treating groundwater continues to be an important consideration for the region. A portion of the region's groundwater requires some sort of remediation or treatment to be suitable for drinking water uses. Within the overall region as of 2004, about 215,000 AF of groundwater underwent some form of treatment, and 85,000 AF was blended with other water supplies to address water quality considerations. Overall, 21 percent of the usable groundwater supply underwent either treatment or blending.

Metropolitan provides financial incentives under its Local Resource Program (LRP) to participating groundwater recovery and recycled water projects developed by local and member agencies. Under the recovered groundwater portion, Metropolitan funds up to $250/AF to recover otherwise unusable groundwater that has been degraded. From 1991 through 2004, more than 306,000 AF of groundwater was treated and recovered under the LRP. In 2004 alone, about 41,000 AF was treated under this program.

GROUNDWATER STORAGE

Existing Groundwater Storage Programs

Metropolitan has historically supported groundwater storage programs within its service area. In 2006, about 600,000 AF of groundwater storage capacity is currently used for a number of programs including Metropolitan's dry-year conjunctive use, supplemental storage and cyclic storage programs. As of June 2006, these programs accounted for about 265,000 AF of stored water.

Metropolitan's initial storage program agreement was with the Calleguas Municipal Water District, executed in 1995. Since then, nine more programs have been developed with the help of State Proposition 13 bond funds and Metropolitan capital funds. Facilities to implement these programs are currently under design and construction, and they are scheduled to be fully operational during 2008. A tenth program, the Raymond Basin conjunctive use program, is currently in preliminary design and environmental review. **Plate ES-5** shows the storage programs as of 2006.

Availability of Groundwater Storage

Taking full advantage of groundwater storage opportunities has many benefits and constraints. Aquifers do not take up valuable real estate or face the same stringent regulations as reservoirs. Water does not evaporate from aquifers. Aquifers are exceptionally good tools for water banking opportunities, providing an excellent repository for excess water in wet years that may be drawn down during dry years. However, many of the aquifers in the Metropolitan service area face some sort of water quality concern, usually in the form of salt content or nitrates from past agricultural practices, but also chemical contamination, such as perchlorate, volatile organic compounds, such as trichloroethylene, and metals, such as hexavalent chromium.

The groundwater basins throughout Metropolitan's service area produce an average of about 1.56 million AF per year of groundwater. Additional storage capacity of 3.2 million AF could potentially be developed within the Metropolitan service area. **Plate ES-6** shows the distribution of available storage capacity in the service area.

Utilizing the additional groundwater storage space would require capture, delivery and recharge of additional water supplies from local runoff, recycled, or imported water sources. A number of factors need to be considered in order to utilize the additional storage space. For example, the availability of additional water supplies may not coincide with the conveyance and recharge capacity. Conveyance capacity for surplus imported water supplies is most available during the cooler months when water demand is low. However, this wetter period also coincides with reduced ability to accomplish in-lieu storage (due to lower water demands) and with increased spreading of local runoff, which may limit the ability to recharge other sources of water. During the very wet year of 2004/05, active recharge throughout the Metropolitan service area utilized approximately 60 percent of the total recharge facility capacity available throughout the course of the year. Therefore, the water agencies need to coordinate the availability of water supplies for storage with overlying demands. Further, other factors to be evaluated in the feasibility of using additional groundwater storage space include: groundwater quality and remedial operations for groundwater contamination, funding for significant investments in capital infrastructure, institutional and legal issues, and physical capability of the aquifer.

SUMMARY

- **Management**: In 2004, 93 percent of the groundwater production came from adjudicated or formally managed groundwater basins.

- **Production**: Each year in the Metropolitan service area, groundwater production accounts for about 1.56 million AF, meeting nearly 40 percent of the water demands.

- **Recharge**: Average annual active groundwater recharge is 758,000 AF. Active groundwater recharge proportionately is using more local runoff and less imported water than in the past.

- **Overdraft**: Over the 20-year study period (1985-2004), groundwater production grew 5 percent faster than groundwater recharge suggesting that total groundwater in storage is declining throughout the service area.

- **Facilities:** Substantial investments have been made in capital infrastructure in support of the use of groundwater. These projects include over 4,000 production wells and nearly 5,000 acres of spreading facilities. Of note, there are 16 groundwater desalters on-line in the Metropolitan service area as of 2006.

- **Water Quality:** TDS and nitrate contamination is a common issue in service area groundwater basins. Other recurring contaminants include VOCs, iron and manganese, and perchlorate.

- **Potential for Storage**: Groundwater basins throughout the area have 3.2 million AF of space available for possible storage.

- **Needs**: Using additional storage opportunity requires:

    - capture, delivery and recharge of additional local and imported surface supplies;

    - improved capability to match availability of surplus surface supplies with conveyance and recharge capacity; and

    - resolution of constraints including: remediation of contamination, institutional and legal issues, funding for significant investment in capital infrastructure, and mismatches in aquifer capability with overlying demand for water supplies.

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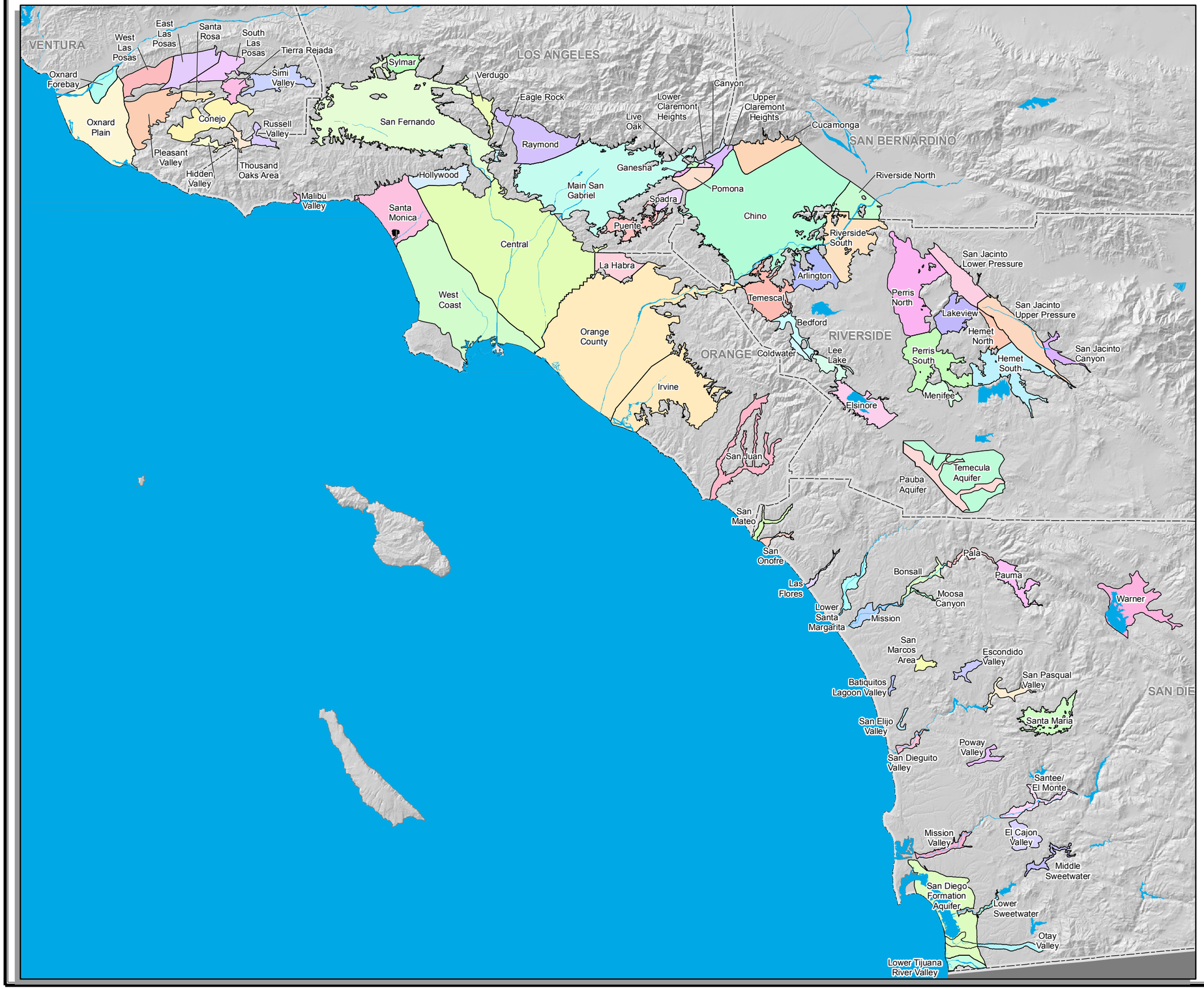

Legend

- Groundwater Basin (color varies)
- Water Body
- County

N W E S

7 3.5 0 7 Miles

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Plate ES-1

Groundwater Basins

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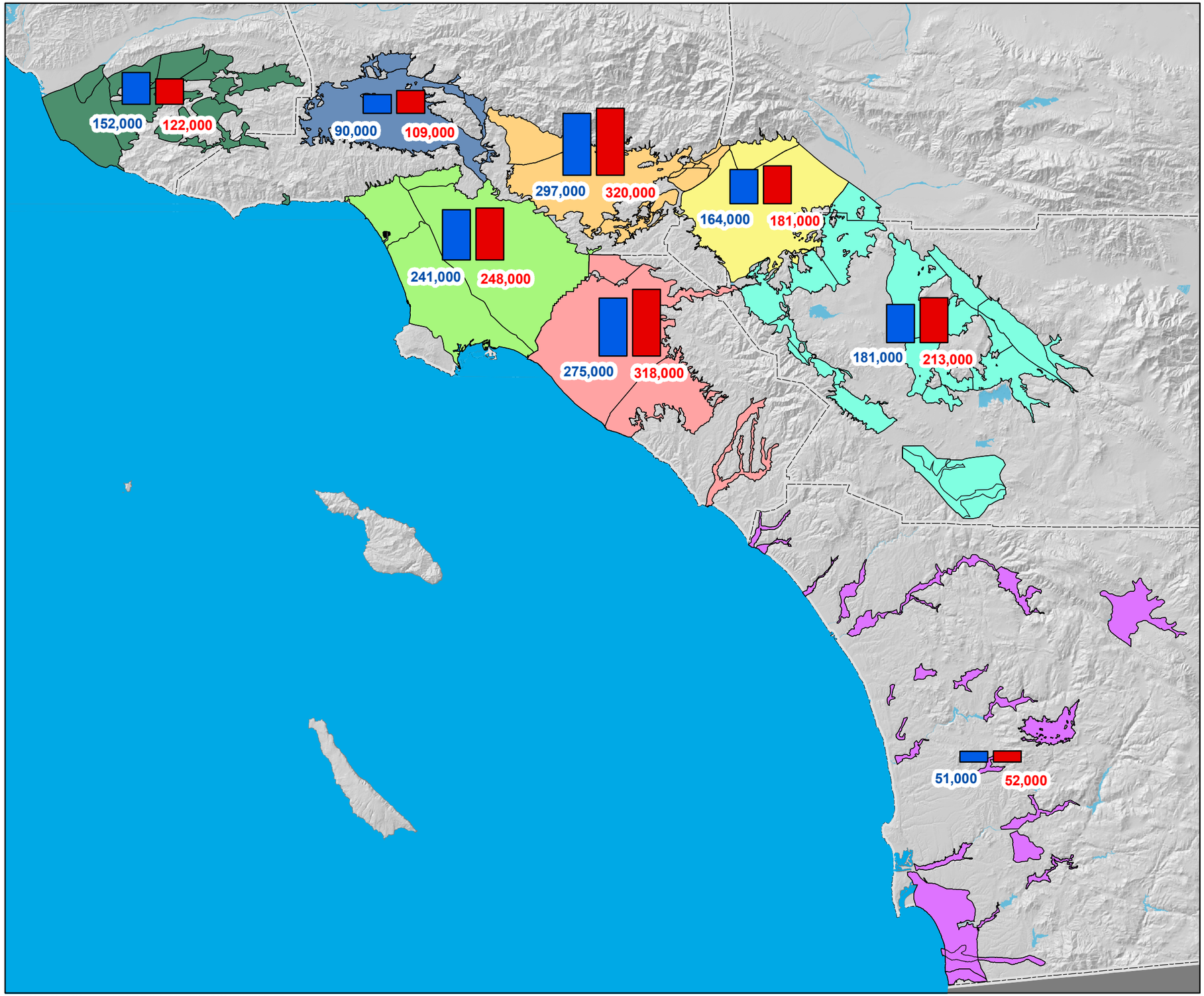

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Legend

Groundwater Basin Sub-Region

- Northwest Metropolitan Service Area Basins
- San Fernando Valley Basins
- Los Angeles County Coastal Plain Basins
- San Gabriel Valley Basins
- Orange County Basins
- Inland Empire Basins
- Eastside Metropolitan Service Area Basins
- San Diego County Basins

Average Annual Production (AFY)

- 160,000
- 1985/86 to 1994/95
- 1995/96 to 2004/05

Other Features

- Water Body
- County

N W E S

6 3 0 6 Miles

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Plate ES-2

Trends in Average Annual Groundwater Production by Sub-Region

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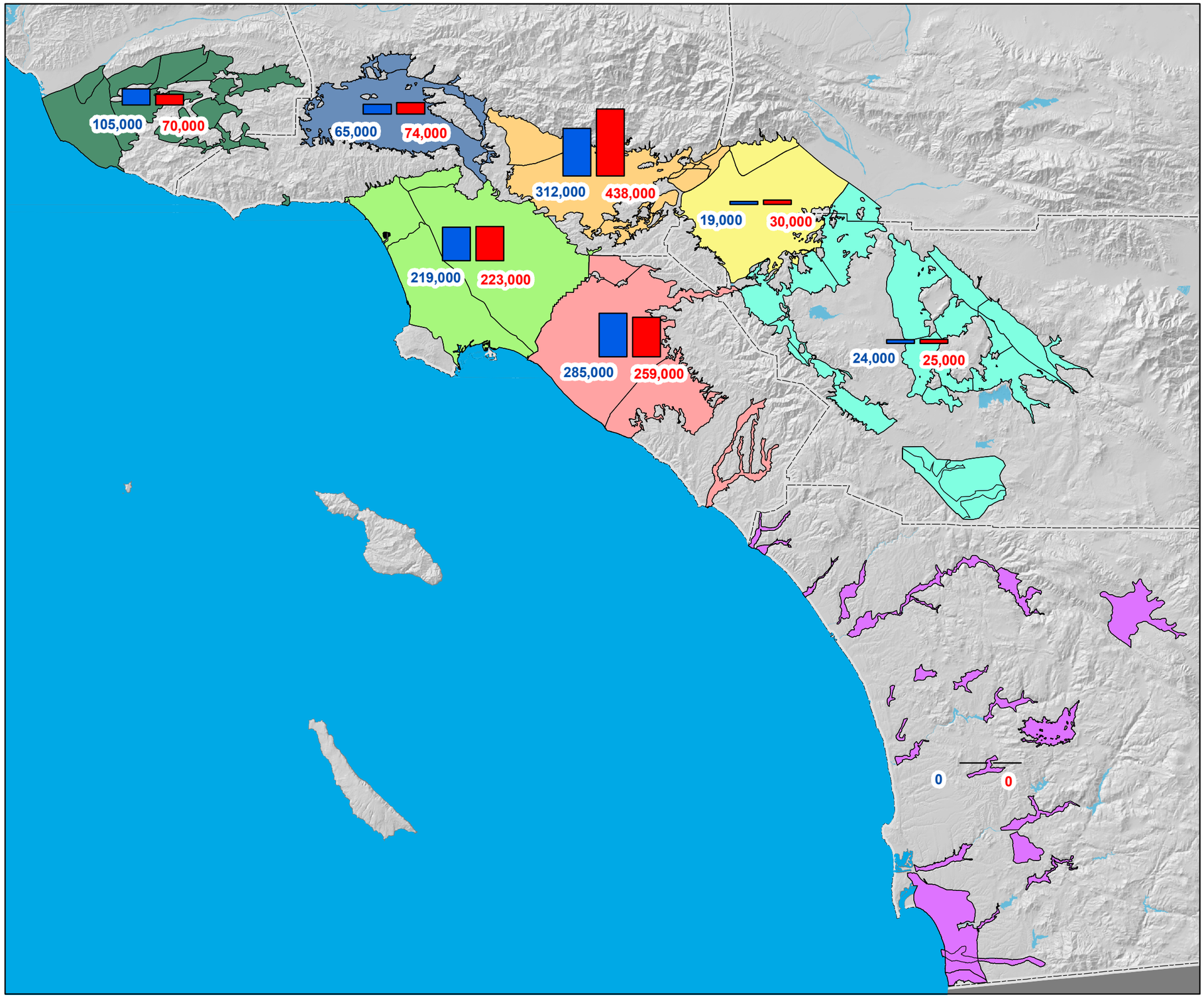

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Legend

Groundwater Basin Sub-Region

- Northwest Metropolitan Service Area Basins
- San Fernando Valley Basins
- Los Angeles County Coastal Plain Basins
- San Gabriel Valley Basins
- Orange County Basins
- Inland Empire Basins
- Eastside Metropolitan Service Area Basins
- San Diego County Basins

Wet Year Direct Recharge (AFY)

- 220,000
- 1992/93
- 2004/05

Other Features

- County
- Water Body

N W E S

6 3 0 6 Miles

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Plate ES-3

Trends in Wet Year Direct Groundwater Recharge by Sub-Region

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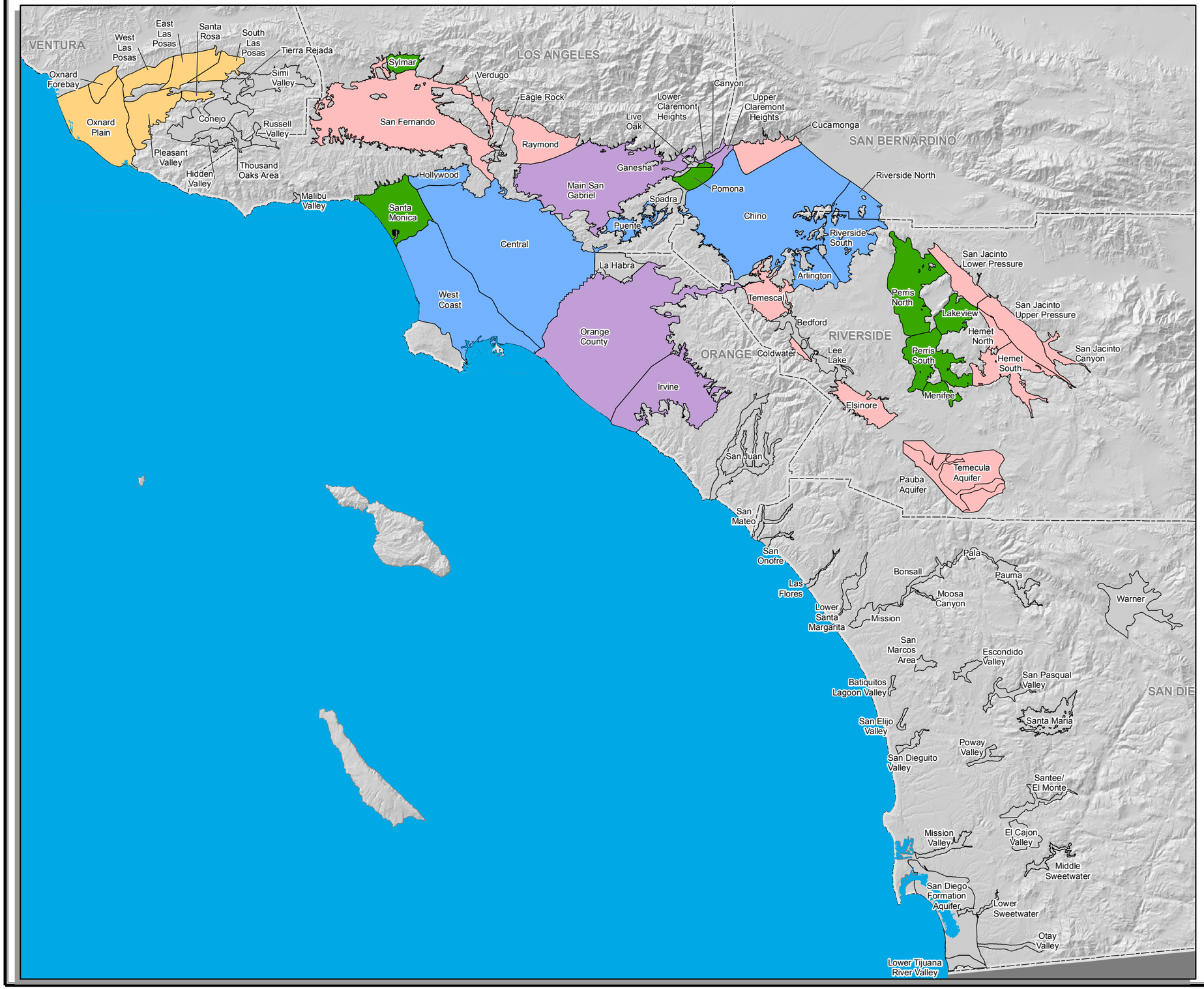

Legend

Groundwater Basin

Water Levels

- Long-term Decline
- Arrested Decline and Recovery
- Stable with Flat Water Levels
- Stable with Wide Swings
- Rising
- Insufficient Data
- County

N W E S

7 3.5 0 7 Miles

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Plate ES-4

Water Level Changes 1985/86 to 2004/05

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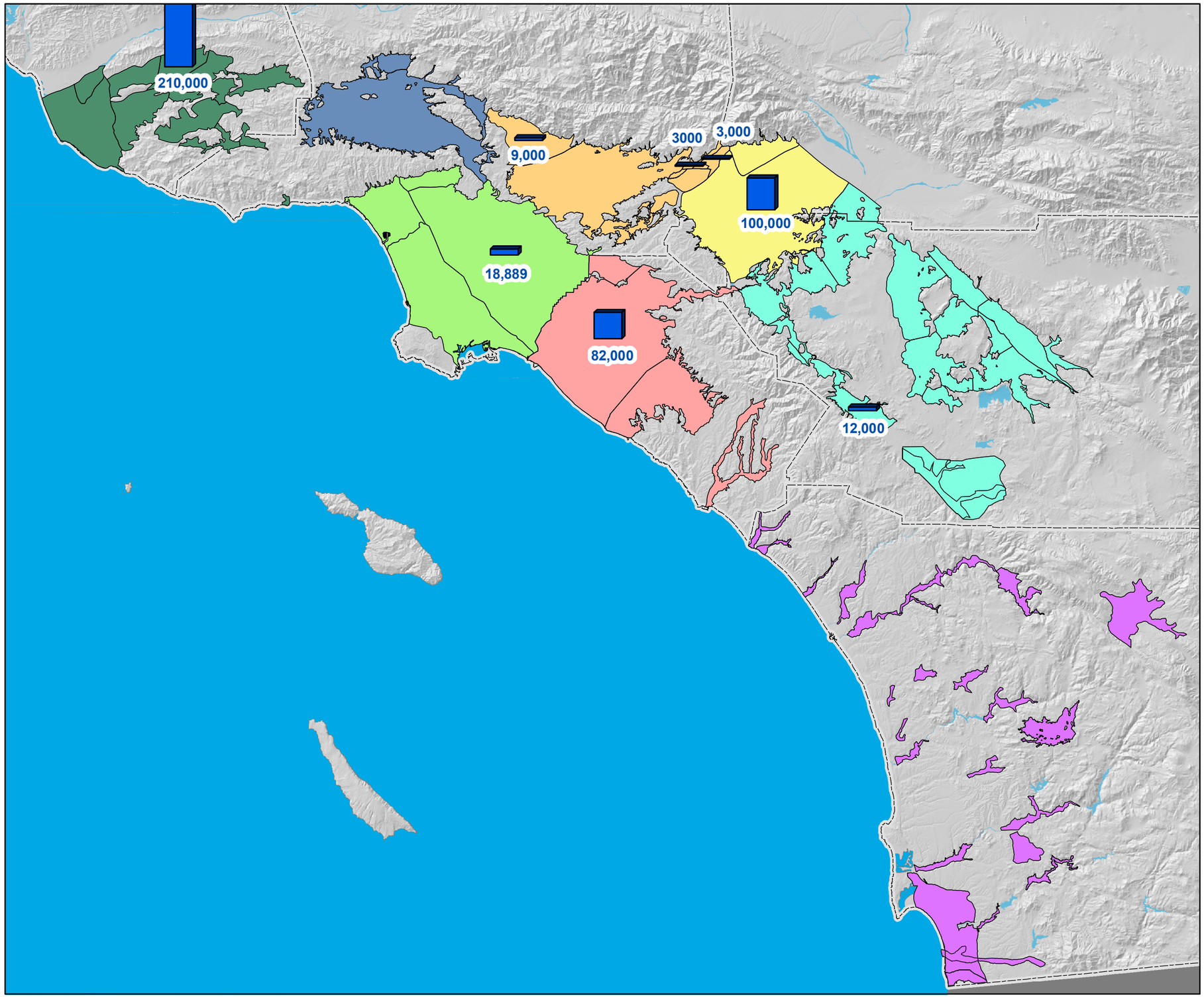

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Legend

Groundwater Basin Sub-Region

- Northwest Metropolitan Service Area Basins
- San Fernando Valley Basins
- Los Angeles County Coastal Plain Basins
- San Gabriel Valley Basins
- Orange County Basins
- Inland Empire Basins
- Eastside Metropolitan Service Area Basins
- San Diego County Basins

Contracted Groundwater Storage (AF)

- 110,000
- Contracted Groundwater Storage

Other Features

- Water Body
- County

N W E S

6 3 0 6 Miles

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Plate ES-5

Contractural Conjunctive Use Programs in 2006

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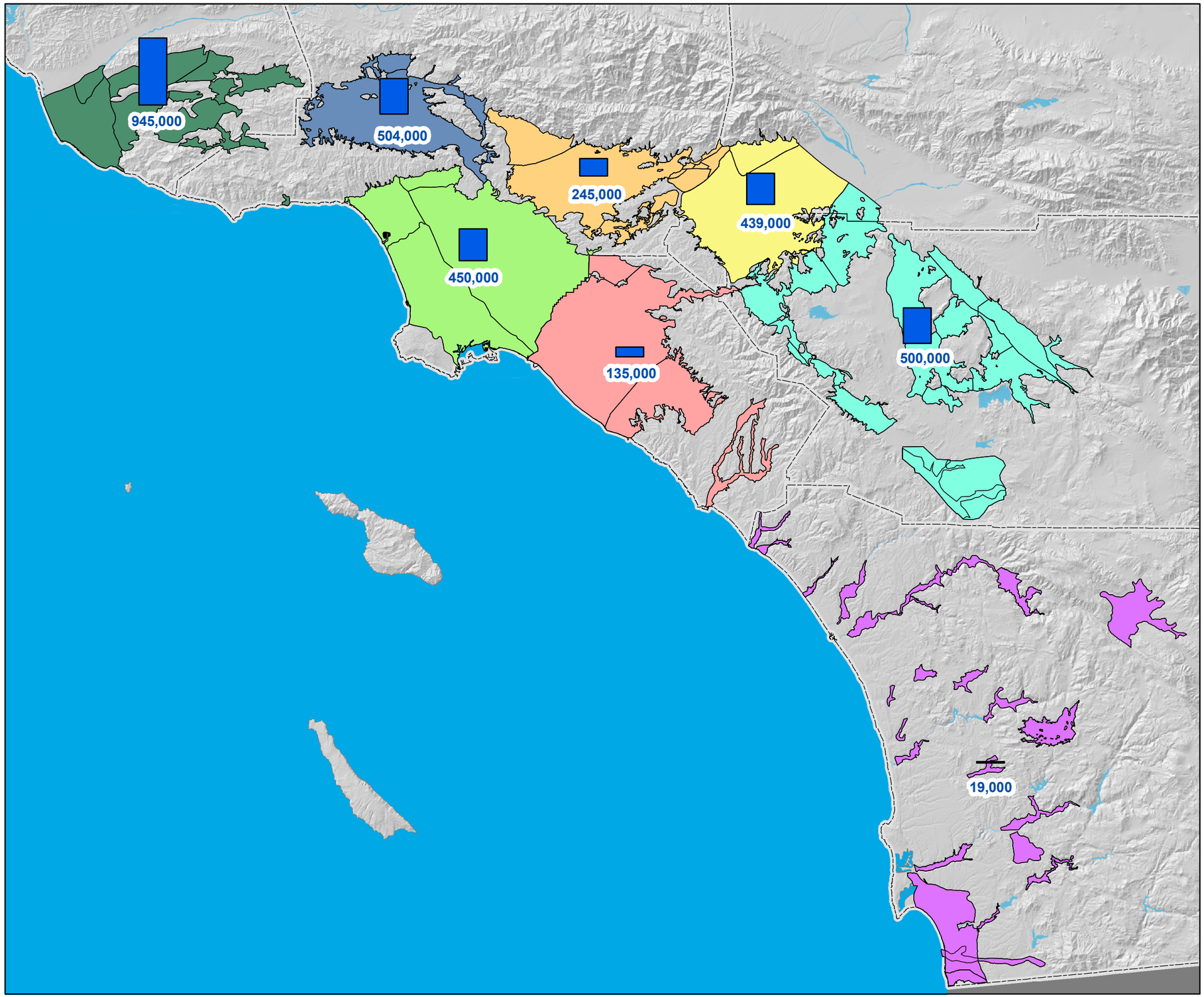

Legend

Groundwater Basin Sub-Region

- Northwest Metropolitan Service Area Basins
- San Fernando Valley Basins
- Los Angeles County Coastal Plain Basins
- San Gabriel Valley Basins
- Orange County Basins
- Inland Empire Basins
- Eastside Metropolitan Service Area Basins
- San Diego County Basins

Available Storage Space (AF)

- 470,000
- Available Storage Space

Other Features

- **Water Body**
- **County**

N W E S

6 3 0 6 Miles

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Plate ES-6

Available Groundwater Storage Space in 2006

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