



# Groundwater Management in California

A Report to the Legislature Pursuant to Senate Bill 1245 (1997)

**1999**

State of California  
The Resources Agency  
DEPARTMENT OF WATER RESOURCES



Photo courtesy of DWR Photography Lab

**COVER PHOTO:**

*The photograph shows the discharge of groundwater from a vertical line-shaft turbine pump into an irrigation ditch. The motor that operates the pump is in the upper left. Development and installation of vertical line-shaft turbine pumps in the 1930s allowed landowners to extract much larger quantities of groundwater in a shorter period of time. As more land was developed for use and more groundwater was extracted, groundwater levels in many basins began to decline.*

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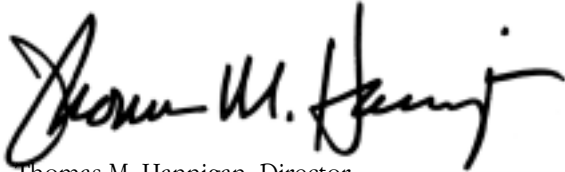


# Foreword

With increasing demand for water created by California's rapidly increasing population, efficient and effective management of all water resources is an issue that affects many people. Efficient management of groundwater resources is necessary so that California's water supply is optimized.

California's groundwater management has been the responsibility of local agencies. Assembly Bill 3030, enacted in 1992, provides an opportunity for local agencies to formalize their groundwater management plans. Many local agencies have used this opportunity to adopt groundwater management plans. In addition, many other local agencies had groundwater management plans prior to 1992, although in some cases it was not a written document.

This report lists agencies that have groundwater management plans that have been adopted either pursuant to different sections of the Water Code, or as a result of a court decision. The contents of the plans vary considerably in their specificity and complexity. These lists of agencies provide an understanding of groundwater management in California that is invaluable when considering future water management options.

A handwritten signature in black ink, appearing to read "Thomas M. Hannigan". The signature is fluid and cursive, with a prominent initial "T" and "H".

Thomas M. Hannigan, Director  
Department of Water Resources



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# Department of Water Resources Organization

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# California Water Commission Membership

State of California  
The Resources Agency  
Department of Water Resources

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**Susan Shafer**

The California Water Commission serves as a policy advisory body to the Director of Water Resources on all California water resources matters. The Commission provides a water resources forum for the people of the State, acts as a liaison between the legislative and executive branches of State government, and coordinates federal, State, and local water resources efforts.

# Conclusions

1. AB 3030 (California Water Code Sections 10750 through 10756) provides a codified procedure for those agencies without a groundwater management plan to develop a plan.
2. The Water Code does not require local agencies to submit their groundwater management plans to DWR. Information about groundwater management was compiled from telephone calls, e-mail, letters, three surveys conducted by the Association of California Water Agencies, and a questionnaire from DWR. The questionnaire was mailed to over 1,000 water agencies; DWR received 650 responses. When a discrepancy was noticed, the agency was contacted for clarification, but this procedure does not guarantee that all discrepancies were eliminated.
3. Not every water agency contacted has provided information concerning their management of groundwater. The information that has been submitted indicates that about 267 agencies have a groundwater management plan and 93 of those agencies have entered into some type of coordinating agreement with other agencies.
4. Twelve counties have adopted ordinances relating to groundwater.
5. Not all agencies that have adopted an AB 3030 groundwater management plan have adopted rules and regulations as required by AB 3030.
6. Not all agencies that have adopted an AB 3030 groundwater management plan have implemented programs as defined in the Water Code.
7. Groundwater rights are determined by case law while surface water rights are determined by the Water Code. Most basins contain a number of agencies, many of which have different statutory authority. These diversities create a complex environment that requires continuous coordination between agencies to design equitable and workable water supply solutions.
8. While many local water agencies are similar, differences in the political, institutional, legal, and technical environment of each agency have resulted in dissimilarities in their water management programs.
9. There is no clear relationship between the groundwater management plans adopted by water agencies and ordinances adopted by overlying or adjacent cities or counties.
10. There is opportunity for cities, counties, and water agencies to work together, using their cumulative statutory authority to develop and operate groundwater management plans to benefit local water users and the state as a whole.
11. In some areas the results of a groundwater level monitoring program are published in an annual report, but the effect of such reporting on groundwater management is not yet clear.

# Recommendations

The Legislature may wish to consider the following recommended actions:

1. Require local agencies to submit groundwater management plans to the Department.
2. Fund the Department to update this report annually and publish the results.
3. Fund the Department to develop a map that shows agency boundaries in each basin and whether that agency has adopted a groundwater management plan.
4. Fund the Department to develop a matrix that shows the type of operational activity, if any, that is included in individual groundwater management plans.
5. Consider incentives to encourage more agencies to engage actively in groundwater management.
6. Fund the Department to develop a model groundwater management ordinance that can be used by local governments in cooperation with local water agencies to manage groundwater resources more efficiently.
7. Consider directing the Department to grant a higher priority for low interest loans for conjunctive use programs to agencies that have implemented a groundwater management program.

# Summary of Groundwater Management

## Groundwater Management Plans

	<u>Number</u>
AB 255 .....	7
AB 3030 .....	156
Other statutory authority .....	75
Adjudication .....	39
Adjudicated groundwater basins .....	16
Groundwater managed by another agency .....	29
Coordinated plans ( <i>includes some of the agencies listed above</i> ) .....	15

## No Groundwater Management Plans

	<u>Number</u>
Groundwater unavailable and/or unusable .....	1
Do not overlie a groundwater basin .....	37
No interest in AB 3030 .....	24

## Groundwater Management Ordinances

	<u>Number</u>
Ordinances .....	10



# Introduction

In 1992, the California Water Code was amended to allow specifically defined local agencies to adopt groundwater management plans. Many agencies took advantage of the amendment and began to consider, and some adopted, groundwater management plans. Some agencies had already adopted groundwater management plans under existing statutory authority in the Water Code. In some cases, the basins had been adjudicated in court. As a result of the 1992 amendment, interest in groundwater management increased considerably.

This report is published in accordance with Water Code Section 10756, requiring DWR to report on groundwater management plans adopted by local agencies. The Water Code does not establish a mechanism requiring local agencies to report such information, so DWR relied on information obtained from three surveys conducted by the Association of California Water Agencies, a DWR questionnaire mailed to more than 1,000 local agencies, and local agency contact with DWR staff; 650 agencies responded to DWR's questionnaire.

In Chapter 1, the six methods of groundwater management that have evolved in California are explained. Chapter 2 lists agencies that have developed and adopted groundwater management plans; agencies are included regardless of the authority under which the plan was adopted and, in some cases, is being carried out. Chapter 3 lists agencies that have no groundwater management plans. Chapter 4 lists the counties that have adopted local ordinances relating to groundwater.

This report and information on California groundwater management are also available on the Internet at the following address:

**<<http://www.dpla.water.ca.gov/cgi-bin/supply/gw/management/hq/main.pl>>**

If we need to update any information or if you have any questions, please call Carl Hauge, Department of Water Resources, at (916) 327-8861 or e-mail at **[chauge@water.ca.gov](mailto:chauge@water.ca.gov)**.





# Chapter 1

## Authority for Development, Adoption, and Implementation of Groundwater Management Plans

In California, there is no mandatory State groundwater management statute. Through time, six methods of groundwater management have evolved. In this chapter, those six methods are summarized in the approximate order in which they became available for use by local agencies.

### 1—Overlying Property Rights

Overlying property rights allow anyone in California to build a well and extract their correlative share of groundwater, which is not defined until a basin is adjudicated. The availability and use of groundwater has increased local prosperity in some areas. In other areas, industries dependent on groundwater have provided enough money to construct a water project that can convey surface water into the local area. Even though the management of groundwater under this method may not have been closely coordinated, it has been called a form of “management.”

### 2—Local Agencies

Twenty-three types of districts, local agencies, or entities are identified in the California Water Code with specific statutory provisions to manage surface water. Some of these agencies have statutory authority to develop some forms of groundwater management. Some of these agencies have done so; others have not. These types of districts, local agencies, and entities that may have statutory authority to manage groundwater are listed below.

#### Types of Agencies with Statutory Authority to Manage Groundwater

California Water District	Municipal Utility District
Community Services District	Municipal Water District
County Sanitation District	Public Utility District
County Service Area	Reclamation District
County Water District	Recreation and Park District
County Water Works District	Sewer and Sewer Maintenance Entity
Flood Control and Water Conservation District	Water Agency or Authority
Harbor and Port District	Water Conservation District
Irrigation District	Water Replenishment District
Joint Exercise of Powers Entity	Water Storage District
Metropolitan Water District	Water Maintenance District
Municipal Improvement District	

### 3—Adjudicated Basins

In basins where a suit is brought to adjudicate the basin (e.g., Alhambra vs. Pasadena) the groundwater rights of all the overlies and appropriators are determined by the court. The court also decides:

- (1) who the extractors are;
- (2) how much groundwater those well owners can extract; and
- (3) who the watermaster will be to ensure that the basin is managed in accordance with the court's decree.

The watermaster must report periodically to the court. There are 16 adjudicated groundwater basins in California; their names and locations are shown on the map on page 5 (Figure 1).

### 4—Special Legislation Districts

In some parts of California, special legislation has been enacted to form groundwater management districts or water management agencies. The legislation allows these districts or agencies to enact ordinances to limit or regulate extraction. There are nine of these groundwater management districts or agencies in California and three agencies that acquired similar authority through amendments to the Water Code. The water management districts or agencies names and locations are shown on the map on page 6 (Figure 2).

### 5—AB 3030

Sections 10750-10756 of the California Water Code (AB 3030, Chapter 947, Statutes of 1992 and amendments) provide a systematic procedure for an existing local agency to develop a groundwater management plan. These sections of the Water Code provide such an agency with the powers of a water replenishment district to raise revenue to pay for facilities to manage the basin (extraction, recharge, conveyance, and quality). One hundred and forty-nine agencies have adopted groundwater management plans in accordance with AB 3030. Other agencies have begun the process.

### 6—City and County Ordinances

In 1995, the California Supreme Court declined to review a lower court decision (Baldwin vs. Tehama County) that holds that State law does not occupy the field of groundwater management and does not prevent cities and counties from adopting ordinances to manage groundwater. Butte, Glenn, Imperial, Inyo, Kern, Sacramento, San Benito, San Diego, San Joaquin, Shasta, Tehama, and Yolo Counties now have groundwater management ordinances. Kern County's ordinance applies only to that portion of the County east of the Sierra Nevada. The nature and extent of the police power of cities and counties to regulate groundwater is presently uncertain.

Figure 1—Adjudicated Groundwater Basins in California

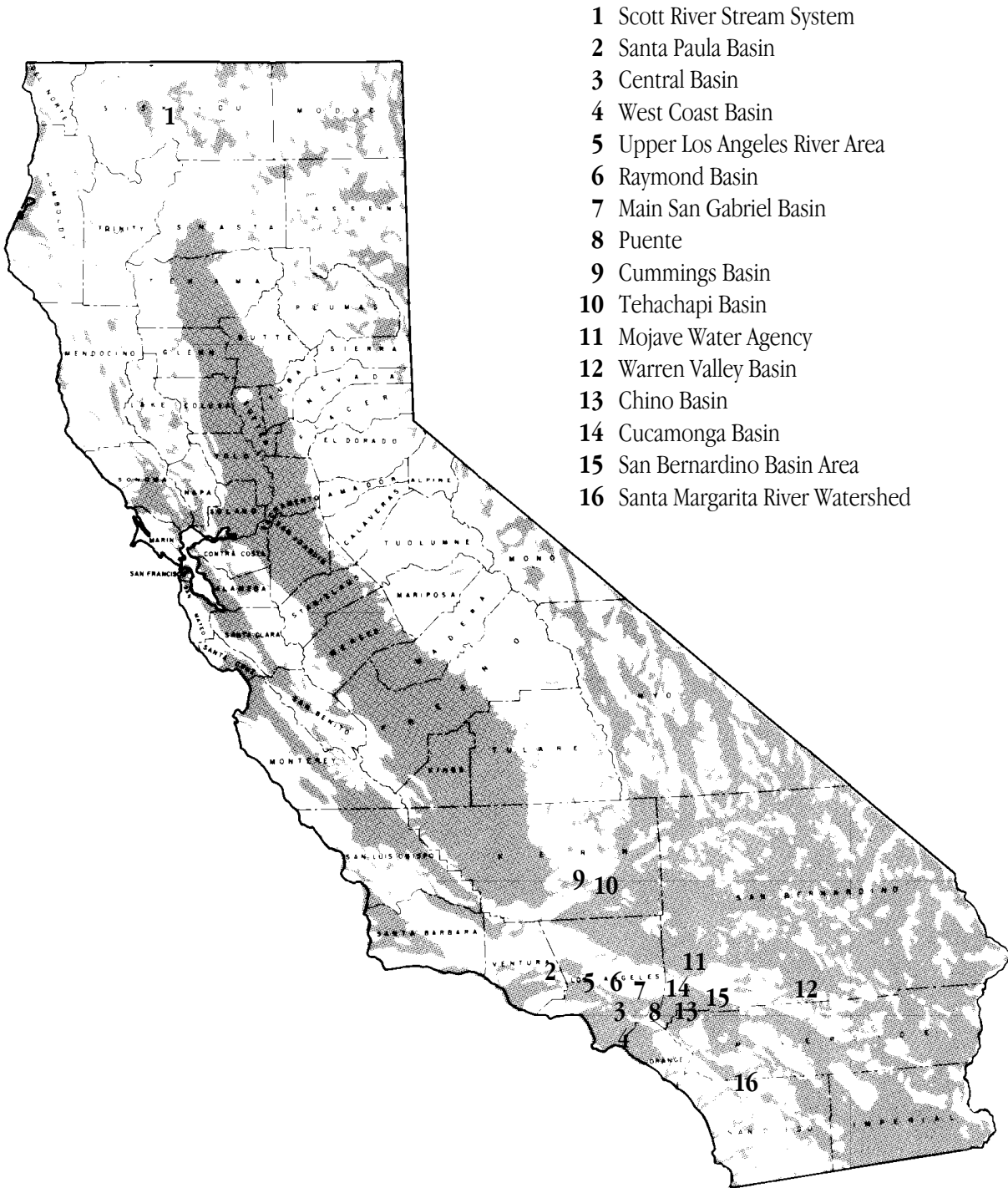
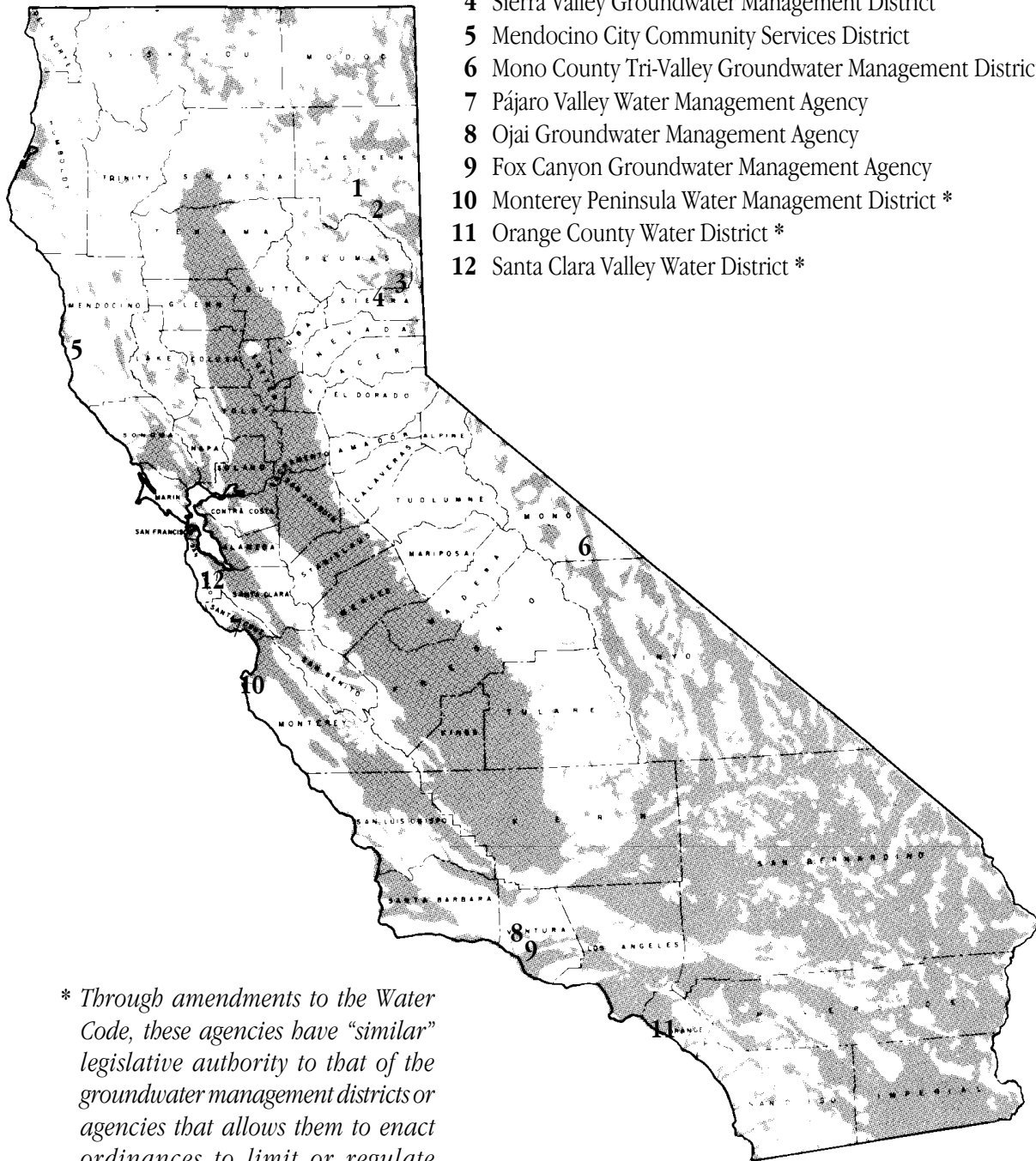


Figure 2—Groundwater Management Districts or Agencies in California

- 1 Willow Creek Groundwater Management Agency
- 2 Honey Lake Valley Groundwater Management District
- 3 Long Valley Groundwater Management District
- 4 Sierra Valley Groundwater Management District
- 5 Mendocino City Community Services District
- 6 Mono County Tri-Valley Groundwater Management District
- 7 Pájaro Valley Water Management Agency
- 8 Ojai Groundwater Management Agency
- 9 Fox Canyon Groundwater Management Agency
- 10 Monterey Peninsula Water Management District \*
- 11 Orange County Water District \*
- 12 Santa Clara Valley Water District \*



*\* Through amendments to the Water Code, these agencies have “similar” legislative authority to that of the groundwater management districts or agencies that allows them to enact ordinances to limit or regulate groundwater extraction.*

# Chapter 2

## Agencies With Groundwater Management Plans

This chapter lists agencies that have a groundwater management plan for that part of the groundwater basin within the agency’s boundaries. The date the agency adopted the groundwater management plan is listed beside the agency name, *unless* the date was not provided by the agency. The agencies are listed under the following headings which indicate the authority under which their groundwater management plans were developed and adopted. (Also see the map in Figure 3, page 8.)

- AB 255
- AB 3030
- COORDINATED PLANS
- OTHER STATUTORY AUTHORITY
- LOCAL AGENCIES’ MEMORANDUM OF UNDERSTANDING
- ADJUDICATION
- GROUNDWATER MANAGED BY ANOTHER AGENCY

In some counties, a water agency has been formed to provide water management services throughout the county. The programs in these counties vary tremendously. One example is Kern County Water Agency which has developed groundwater management plans for various areas within its boundaries, in cooperation with the local agencies. Kern County Water Agency measures groundwater levels throughout Kern County and coordinates and combines these data with the groundwater level measurements collected by local agencies, DWR, and the U.S. Bureau of Reclamation. In addition, some of the local agencies within Kern County have adopted their own groundwater management plans, under either AB 3030 or some other statutory authority.

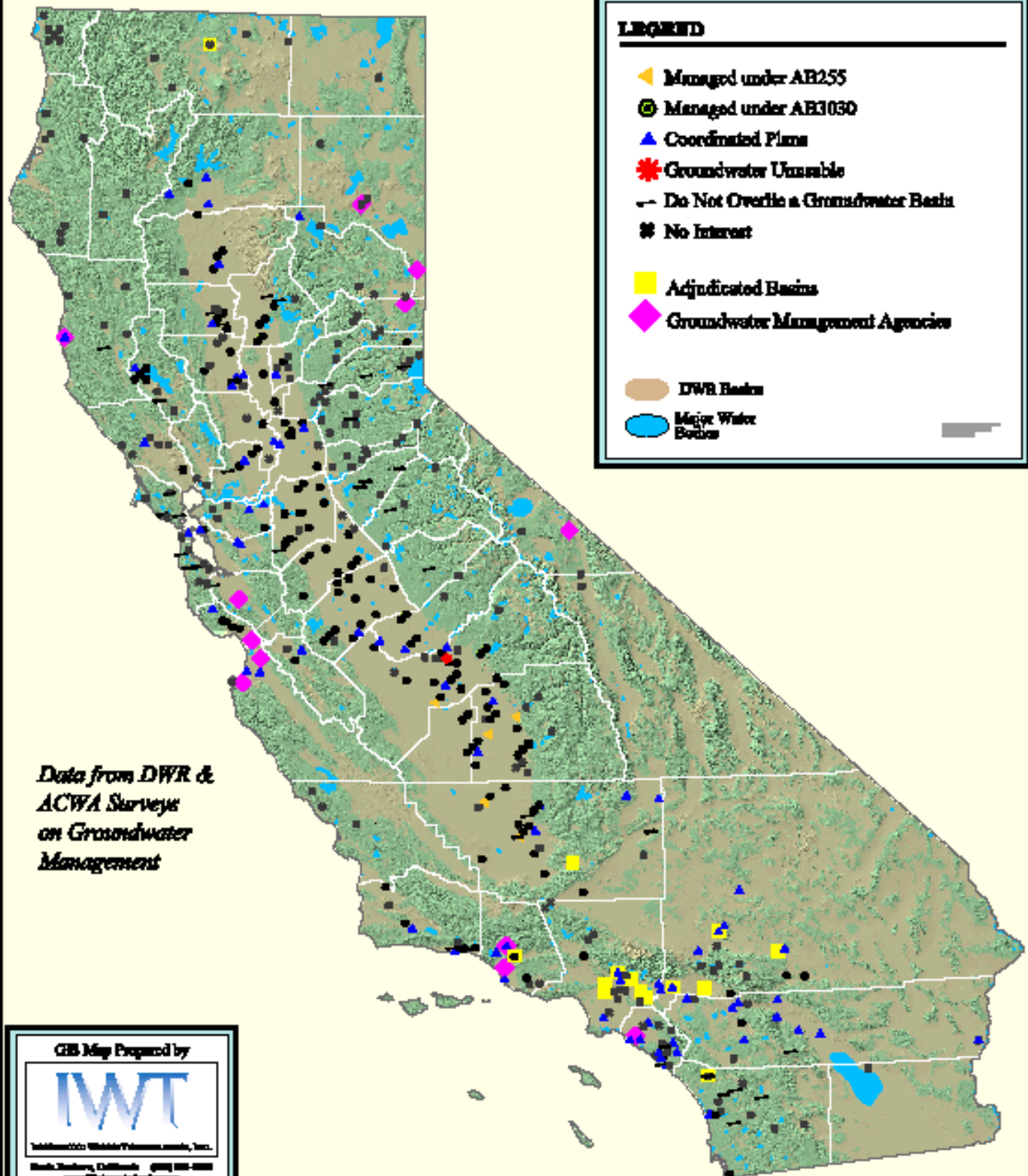
### AB 255

In 1991, the Water Code was amended by AB 255 to allow local agencies overlying critically overdrafted groundwater basins to develop groundwater management plans. The following table lists these agencies.

Buena Vista Water Storage District	10/14/97	North Kern Water Storage District	10/19/93
Exeter Irrigation District		Shafter-Wasco Irrigation District	06/08/93
Kings County Water District	01/07/93	Tulare Irrigation District	11/19/92
Laguna Irrigation District			

# Status of Groundwater Management in California

Updated to April 1998



GIS Map Prepared by

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## AB 3030

The following agencies have adopted groundwater management plans in accordance with AB 3030 (1992). AB 3030 repealed Water Code §§ 10750-10767 and replaced them with §§ 10750-10755.4. Since then, two amendments, AB 1152 (1993) and SB 1245 (1997), have been added to AB 3030. The complete Water Code reference is now §§ 10750-10756. The agencies marked with an asterisk (\*) have entered into a memorandum of understanding, joint powers authority, or cooperative agreement with other agencies to manage groundwater. The coordinating entities are listed on pages 12 and 13.

Alpaugh Irrigation District*	08/14/95	Citrus Heights Irrigation District*	11/14/94
Alta Irrigation District	08/14/94	City of Atwater*	
Angiola Water District*	07/14/95	City of Buellton*	
Arcade County Water District*	11/14/94	City of Ceres*	09/23/97
Arden-Cordova Water Service*	11/14/94	City of Corcoran*	09/03/96
Atwell Island Water District*	10/09/95	City of Folsom*	11/14/94
Ballico Community Services District*		City of Galt*	11/14/94
Ballico-Cortez Water District*	11/97	City of Hughson*	11/10/97
Banta-Carbona Irrigation District*	05/15/96	City of Livingston*	
Bear Valley Community Services District	11/14/98	City of Merced*	
Biggs-West Gridley Water District	11/15/95	City of Tracy*	05/21/96
Black Rascal Water Company*		City of Turlock*	11/25/97
Broadview Water District*	12/10/96	Clay Water District*	11/14/94
Burrel Ditch Company*		Columbia Canal Company*	12/05/97
Butte Water District	05/13/96	Consolidated Irrigation District	08/05/95
Byron-Bethany Irrigation District		Corcoran Irrigation District*	05/09/95
Camrosa Water District	04/24/97	County of Fresno	03/11/97
Carmichael Water District*	11/14/94	County of Merced*	
Carpinteria Valley Water District	08/14/96	County of Merced*	
Cawelo Water District	06/21/94	County of Stanislaus*	
Central California Irrigation District*	12/05/97	Crescent Canal Company*	
Central Water District	04/02/96	Delhi County Water District*	
Chowchilla-Red Top Resource Conservation District*	12/03/97	Del Puerto Water District*	06/19/96
Chowchilla Water District*	12/03/97	Denair Community Services District*	09/17/97
		Eagle Field Water District*	11/27/96

Eastern Municipal Water District	06/08/95	Maine Prarie Water District	
East Merced Resource Conservation District*		Meadowbrook Water Company*	
Eastside Water District*	09/25/97	Melga Water District*	05/18/95
El Camino Irrigation District	12/12/95	Merced Irrigation District	01/09/97
Elk Grove Water Works*	11/14/94	Merced Irrigation District*	11/18/97
El Nido Irrigation District		Merced Irrigation District*	
Fair Oaks Water District*	11/14/94	Mercy Springs Water District*	12/10/96
Firebaugh Canal Water District*	12/05/97	Merquin County Water District*	
Fresno Irrigation District	08/12/96	Mid-Valley Water District*	04/11/97
Galt Irrigation District*	11/14/94	Modesto Irrigation District	03/26/96
Glenn-Colusa Irrigation District		Newhall County Water District	12/12/96
Gravelly Ford Water District	03/09/98	North Kern Water Storage District	
Hills Valley Irrigation District*		Northridge Water District*	11/14/94
Hilmar County Water District*	12/02/97	North San Joaquin Water Conservation District	03/05/96
James Irrigation District	05/07/96	Oakdale Irrigation District	09/22/95
Joshua Basin County Water District	04/03/96	Omochumne-Hartnell Water District*	11/14/94
Kaweah Delta Water Conservation District	07/05/95	Orange Cove Irrigation District*	
Kern Delta Water District	10/15/96	Orange Vale Mutual Water Company*	11/14/94
Keyes Community Services District*		Ora Loma Water District*	12/03/96
Kings River Conservation District*		Pacheco Water District*	11/20/96
Kings River Water District	08/17/95	Panoche Water District*	12/17/96
Lakeside Irrigation Water District		Patterson Water District*	05/06/96
LeGrand-Athlone Water District*		Pixley Irrigation District*	03/24/95
LeGrand Community Services District*		Plain View Water District*	05/21/96
Liberty Canal Company*		Planada Community Services District*	
Liberty Mill Race Company*		Porterville Irrigation District*	03/24/95
Liberty Water District	05/14/96	Princeton-Codora-Glenn Irrigation District	02/14/96
Lovelace Reclamation District 739	06/24/97	Raisin City Water District*	04/11/97
Lower Tule River Irrigation District*	03/24/95	Rancho Murieta Community Services District*	11/14/94
Madera Water District	12/10/97		



Reclamation District 108	03/08/95	Stevinson Water District*	
Reclamation District 787	02/25/97	Stinson Canal and Irrigation Company*	
Reclamation District 2035	04/25/95	Stockton East Water District	11/01/95
Reclamation District 2068		Stone Corral Irrigation District*	03/24/95
Reed Ditch Company*		Sutter Extension Water District	08/15/95
Richvale Irrigation District	11/15/95	Sweetwater Authority	
Rio Linda Water District*	11/14/94	Tehama County Flood Control and Water Conservation District	
Riverdale Irrigation District	12/06/95	Terra Bella Irrigation District*	03/24/95
Root Creek Water District	10/13/97	Tia Juana Valley County Water District	02/07/95
Rosamond Community Services District		Tri-Valley Water District*	
Rosedale-Rio Bravo Water Storage District	03/11/97	Truckee-Donner Public Utility District	
San Joaquin County Flood Control & Water Conservation District*	02/11/97	Tulare Lake Basin Water Storage District*	05/02/95
San Juan Water District*	11/14/94	Tulare Lake Reclamation District 761	07/12/96
San Luis Canal Company*	12/05/97	Turlock Irrigation District*	10/14/97
San Luis Rey Municipal Water District	04/17/96	Turner Island Water District*	
San Luis Water District*	11/19/96	United Water Conservation District	
Santa Maria Valley Water Conservation District	09/01/95	West Kern Water District	04/22/97
Santa Ynez River Water Conservation District*	11/01/95	Western Canal Water District	03/21/95
Saucelito Irrigation District*	03/24/95	Westlands Water District	09/16/96
Scotts Valley Water District	10/13/94	West Side Irrigation District*	05/08/96
Solano Irrigation District	02/95	West Stanislaus Irrigation District*	05/14/96
Soquel Creek Water District	04/02/96	Widren Water District*	07/07/97
South San Joaquin Irrigation District	02/14/95	Winton Water and Sanitation District*	
South Sutter Water District		Woodbridge Irrigation District	

## COORDINATED PLANS

The following agencies have entered into a joint powers authority, joint powers agreement, memorandum of understanding, cooperative agreement, or some type of less formal agreement to develop a coordinated groundwater management plan with other agencies in the groundwater basin. These agencies are also listed alphabetically on pages 9, 10, and 11, and are identified by an asterisk (\*) symbol after their names.

### **Chowchilla Water District-Red Top Resources Conservation District Joint Powers Authority—AB 3030 plan adopted December 3, 1997.**

Chowchilla Water District                      Chowchilla-Red Top Resource Conservation District

### **Deer Creek and Tule River Authority—Formed in 1994; AB 3030 plan adopted March 24, 1995.**

Lower Tule River Irrigation District      Porterville Irrigation District              Stone Corral Irrigation District  
Pixley Irrigation District                      Saucelito Irrigation District              Terra Bella Irrigation District

### **Kings River Conservation District—Area A.**

Mid-Valley Water District                      Raisin City Water District

### **Kings River Conservation District—Area B—MOU to accept Kings River Conservation District's plan.**

Burrel Ditch Company                      Liberty Canal Company                      Reed Ditch Company  
Crescent Canal Company                      Liberty Mill Race Company                      Stinson Canal and Irrigation  
Company

### **Kings River Conservation District—Area C—Execution of MOUs with local water management entities is pending.**

### **Merced Area Groundwater Pool Interests—Draft document distributed on December 12, 1997 for review and approval.**

Black Rascal Water Company                      LeGrand-Athlone Water District                      Planada Community Services  
City of Atwater                                      LeGrand Community Services                      District  
City of Livingston                                      District    Stevinson Water District  
City of Merced                                      Meadowbrook Water Company                      Turner Island Water District  
County of Merced                                      Merced Irrigation District                      Winton Water and Sanitary District  
East Merced Resource  
Conservation District

### **Orange Cove Groundwater Management Plan—AB 3030 plan adopted December 22, 1997.**

Hills Valley Irrigation District                      Orange Cove Irrigation District                      Tri-Valley Water District

**Sacramento Metropolitan Water Authority—Adopted AB 3030 plan on November 14, 1994. Florin County Water District joined the authority but has not approved the groundwater management plan.**

Arcade County Water District	Clay Water District	Orange Vale Mutual Water Company
Arden-Cordova Water Service	Elk Grove Water Works	Rancho Murieta Community Services District
Carmichael Water District	Fair Oaks Water District	Rio Linda Water District
Citrus Heights Irrigation District	Galt Irrigation District	San Juan Water District
City of Folsom	Northridge Water District	
City of Galt	Omochumne-Hartnell Water District	

**San Joaquin River Exchange Contractors Water Authority—AB 3030 plan adopted December 5, 1997 by the Authority as a whole—not by the individual agencies and companies composing the Authority.**

Central California Irrigation District	Firebaugh Canal Water District
Columbia Canal Company	San Luis Canal Company

**San Luis and Delta-Mendota Water Authority North**

Banta-Carbona Irrigation District	Patterson Water District	West Side Irrigation District
City of Tracy	Plain View Water District	West Stanislaus Irrigation District
Del Puerto Water District	San Joaquin County Flood Control and Water Conservation District	

**San Luis and Delta-Mendota Water Authority South**

Broadview Water District	Ora Loma Water District	San Luis Water District
Eagle Field Water District	Pacheco Water District	Widren Water District
Mercy Springs Water District	Panoche Water District	

**Santa Ynez River Water Conservation District**

City of Buellton	Santa Ynez River Water Conservation District
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**Tulare Lake Bed Coordinated Groundwater Management Plan—AB 3030 plan adopted on December 12, 1995. In addition to the eight agencies listed, two landowners have signed the MOU.**

Alpaugh Irrigation District	City of Corcoran	Melga Water District
Angiola Water District	Corcoran Irrigation District	Tulare Lake Basin Water Storage District
Atwell Island Water District	Lovlace Reclamation District 739	

**Turlock Groundwater Basin Association Groundwater Management Plan—City of Modesto is a signatory in the authority but has not approved the groundwater management plan.**

Ballico Community Services District	County of Merced	Hilmar County Water District
Ballico-Cortez Water District	County of Stanislaus	Keyes Community Services District
City of Ceres	Delhi County Water District	Merced Irrigation District
City of Hughson	Denair Community Services District	Turlock Irrigation District
City of Turlock	Eastside Water District	

## OTHER STATUTORY AUTHORITY

Groundwater in the areas of the following agencies is managed under a section of the California Water Code other than § 10750 et seq. The Water Code reference is noted when it is known.

Alameda County Flood Control and Water Conservation District, <i>(WC § 30,000 et. seq.)</i>	Mono County Tri-Valley Groundwater Management District, <i>(WC App. 128)</i>
Aromas County Water District	Monterey County Water Resources Agency
Arvin-Edison Water Storage District, <i>(WC Div. 14)</i>	Monterey Peninsula Water Management District, <i>(WC App. 118)</i>
Big Bear Municipal Water District	Moulton Niguel Water District
Capistrano Valley Water District	Murrieta County Water District
Central Coast Water Agency	Ojai Basin Groundwater Management Agency, <i>(WC App. 131)</i>
Channel Islands Beach Community Services District	Orange County Water District
City of Buellton	Pájaro Valley Water Management Agency, <i>(WC App. 124)</i>
City of Hollister	Pájaro/Sunny Mesa Community Services District
City of Huntington Beach	Palm Desert Water and Sanitation District
City of Riverside	Pebble Beach Community Services District
City of Sacramento	Pleasant Valley County Water District
City of Santa Barbara	Sacramento County Water Management District
Coachella Valley Water District	Sacramento North Area Groundwater Management Authority (SNAGMA)
Delhi County Water District	<ul style="list-style-type: none"> <li>• Arcade Water District</li> <li>• Carmichael Water District</li> <li>• Citizens Utilities</li> <li>• Citrus Heights Water District</li> <li>• City of Citrus Heights</li> <li>• City of Folsom</li> <li>• City of Sacramento</li> <li>• County of Sacramento</li> <li>• Del Paso Manor Water District</li> <li>• Fair Oaks Water District</li> </ul>
Desert Water Agency	• Natomas Central Mutual Water Company
Dublin San Ramon Community Services District	<ul style="list-style-type: none"> <li>• Northridge Water District</li> <li>• Orange Vale Water Company</li> </ul>
East Niles Community Services District	• Rio Linda/Elverta Community Water District
Fox Canyon Groundwater Management Agency, <i>(WC App. 121)</i>	<ul style="list-style-type: none"> <li>• San Juan Water District</li> <li>• self-supplied agriculture</li> <li>• self-supplied industry</li> </ul>
Goleta Water District	• Southern California Water Company
Honey Lake Valley Groundwater Management District, <i>(WC App. 129)</i>	Sacramento River West Side Levee District
Indian Wells Valley Water District	San Benito County Water District
Irvine Ranch Water District	San Juan Basin Authority
Knights Landing Ridge Drainage District	Santa Clara Valley Water District
Laguna Irrigation District	Santa Ynez River Water Conservation District
Long Valley Groundwater Management District, <i>(WC App. 119)</i>	
Malaga County Water District	
Marina Coast Water District	
Mesa Consolidated Water District	

Semitropic Water Storage District (WC Div. 14)

Sierra Valley Groundwater Management District, (WC App. 119)

St. Johns Water District

Sunnyslope County Water District

Tehama-Colusa Canal Authority

Trabuco Canyon Water District

Tulare Irrigation District

W.H. Wilbur Reclamation District 825

Wheeler Ridge-Maricopa Water Storage District, (1967, WC Div. 14)

Willow Creek Valley Groundwater Management District, (WC App. 135)

### LOCAL AGENCIES' MEMORANDUM OF UNDERSTANDING

The following agencies have joined in a memorandum of understanding that creates an advisory committee to recommend actions for groundwater management. The advisory committee plans to evaluate the AB 3030 groundwater management plan adopted by Scotts Valley Water District and continue monitoring groundwater conditions and AB 3030 related groundwater management planning in the Santa Margarita area. Advisory committee recommendations are *advisory only* and are not binding.

City of Scotts Valley

County of Santa Cruz

Lompico County Water District

San Lorenzo Valley Water District

Scotts Valley Water District

## ADJUDICATION

The following agencies manage groundwater in accordance with the court decision that governs the groundwater basin. These agencies overlie an adjudicated groundwater basin.

Apple Valley Heights County Water District	Orchard Dale Water District
Apple Valley Ranchos Water Company	Rancho California Water District
Baldy Mesa Water District	Rowland Water District
Chino Basin Water Conservation District	San Bernardino Valley Municipal Water District
City of Adelanto	San Gabriel Basin Water Quality Agency
City of Barstow	San Gabriel County Water District
City of Lakewood	Santa Fe Irrigation District
Crescenta Valley Water District	Santa Margarita Water District
Cucamonga County Water District	Serrano Irrigation District
Foothill Municipal Water District	South Montebello Irrigation District
Hesperia County Water District	Tehachapi-Cummings County Water District
Hidden Valley Lake Community Services District	Three Valleys Municipal Water District
Hi-Desert County Water District	Upper San Gabriel Valley Municipal Water District
Jurupa Community Services District	Valley County Water District
Kinneola Irrigation District	Victor Valley County Water District
La Cañada Irrigation District	Walnut Valley Water District
Los Angeles Department of Water and Power	Water Replenishment District of Southern California
Main San Gabriel Basin Watermaster	West San Bernardino County Water District
Mariana Ranchos County Water District	
Mojave Water Agency	
Monte Vista Water District	

## Adjudicated Groundwater Basins

This section lists the 16 adjudicated groundwater basins in California in the order of the date of the court decision, followed by the court-appointed watermaster and the local agencies that overlie a part of the adjudicated groundwater basin (if known). The locations of these adjudicated groundwater basins are shown on the map on page 5.

### **1944—Raymond Basin**

Watermaster is the Raymond Basin Management Board. Foothill Municipal Water District; Kinneola Irrigation District; La Cañada Irrigation District.

### **1958—Cucamonga Basin**

Watermaster is Cucamonga County Water District and San Antonio Water Company.

### **1961—West Coast Basin**

Watermaster is DWR. City of Lakewood; Water Replenishment District of Southern California.

### **1965—Central Basin**

Watermaster is DWR. Orchard Dale Water District; South Montebello Irrigation District; Water Replenishment District of Southern California.

### **1966—Santa Margarita River Watershed**

Watermaster is an attorney. Fallbrook Public Utility District; Rancho California Water District; Santa Margarita Water District; U.S. Marine Corps, Camp Pendleton.

### **1969—San Bernardino Basin Area**

Watermaster is one representative each from Western Municipal Water District of Riverside and San Bernardino Valley Municipal Water District. Jurupa Community Services District; San Bernardino Valley Municipal Water District.

### **1972—Cummings Basin**

Watermaster is Tehachapi-Cummings County Water District.

### **1973—Tehachapi Basin**

Watermaster is Tehachapi-Cummings County Water District.

### **1973—Main San Gabriel Basin**

Watermaster is a nine-member board elected from water purveyors and water districts. Main San Gabriel Basin Water Quality Agency; San Gabriel County Water District; San Gabriel Valley Municipal Water District; Three Valleys Municipal Water District; Upper San Gabriel Valley Municipal Water District; Valley County Water District.

### **1977—Warren Valley Basin**

Watermaster is Hi-Desert County Water District.

### **1978—Chino Basin**

Watermaster is Chino Basin Municipal Water District. Chino Basin Water Conservation District; City of Chino; City of Chino Hills; City of Upland; Cucamonga County Water District; Jurupa Community Services District; Monte Vista

Water District; Three Valleys Municipal Utility District. Santa Ana Watershed Project Authority is working with the watermaster on water quality.

### 1979—Upper Los Angeles River Area

Watermaster is an employee of the Los Angeles Department of Water and Power.

### 1980—Scott River Stream System

Watermaster is two local irrigation districts.

### 1985—Puente

Watermaster is three consultants. Rowland Water District; Walnut Valley Water District.

### 1996—Santa Paula Basin

Watermaster is a three-person Technical Advisory Committee from United Water Conservation District, City of Ventura, and Santa Paula Basin Pumpers Association.

### 1996—Mojave Basin

Watermaster is Mojave Water Agency. Apple Valley Heights County Water District; Apple Valley Ranchos Water Company; Baldy Mesa County Water District; City of Barstow; City of Adelanto, Hesperia Water District; Mariana Ranchos County Water District; Victor Valley Water District.

## GROUNDWATER MANAGED BY ANOTHER AGENCY

Another agency manages the groundwater in the area overlain by the following local agencies.

Big Bear Municipal Water District  
Cachuma Operations and Maintenance Board  
Cachuma Project Authority  
Capistrano Valley Western Water District  
Carpenter Irrigation District  
Central Coast Water Authority  
City of Buellton  
City of Huntington Beach  
City of Lompoc  
City of Riverside Public Utility District  
City of Santa Ynez  
City of Solvang  
East Orange County Water District  
El Dorado County Water Agency  
Irvine Ranch Water District

Kern County Water Agency  
Knights Landing Ridge Drainage District  
Marina Coast Water District  
Pájaro/Sunny Mesa Community Services District  
Palm Desert Water and Sanitation District  
Pebble Beach Community Services District  
Pleasant Valley County Water District  
Sacramento River Westside Levee District  
Santa Ana Watershed Project Authority  
Santiago County Water District  
Serrano Irrigation District  
St. Johns Water District  
Sunnyslope County Water District  
Tehama-Colusa Canal Authority



# Chapter 3

## Agencies Without Groundwater Management Plans

The agencies listed in this chapter have not adopted a groundwater management plan for the reasons given in each heading. Groundwater is either unavailable or unusable because of naturally occurring poor water quality, the agency does not overlie a groundwater basin, or the agency has expressed no interest in AB 3030 or other groundwater management tools. In addition, over 200 agencies listed in Appendix B have not adopted a groundwater management plan. These agencies may change their position at any time and decide to develop a groundwater management plan.

### GROUNDWATER UNAVAILABLE, UNUSABLE, OR BOTH

Dudley Ridge Water District

### DO NOT OVERLIE A GROUNDWATER BASIN

The following local agencies do not overlie a groundwater basin as defined in DWR Bulletin 118 and its supplements, and therefore do not qualify under the definition of “local agency” contained in AB 3030 [WC § 10752 (b)].

Adams Springs Water District	Midway Heights County Water District
Bear Valley Water District	Montecito County Water District
Belmont County Water District	Moulton-Niguel Water District
Belridge Water Storage District	North Coast County Water District
Berrenda Mesa Water District	North Marin Water District
Bolinas Community Public Utility District	Oroville-Wyandotte Irrigation District
Calaveras County Water District	Paradise Irrigation District
Calaveras Public Utility District	Pescadero Reclamation District 2058
City of Fairfield	Pinyon Pines County Water District
City of Poway	Purissima Hills Water District
Coastal Municipal Water District	Rand Communities County Water District
Coastside County Water District	Redwood Valley County Water District
El Dorado County Water Agency	Rincón del Diablo Municipal Water District
Fallbrook Public Utility District	South Coast County Water District
Foresthill Public Utility District	Tahoe City Public Utility District
Glide Water District	Tuolumne Utilities District
Kanawha Water District	Valley Center Municipal Water District
Marin Municipal Water District	Wynola Water District
Mariposa Public Utility District	

## NO INTEREST IN AB 3030

In response to the ACWA surveys, the following agencies indicated that landowners within the district showed no interest in developing an AB 3030 groundwater management plan.

Amador County Department of Water Resources  
Big Bear Area Regional Wastewater Agency  
Big Bear City Community Services District  
Bodega Bay Public Utility District  
Brooktrails Township Community Services District  
Contra Costa County Water District  
Cottonwood County Water District  
Descanso Community Services District  
Los Alamos Community Services District  
Mountain Gate Community Services District  
North Marin Water District  
Otay Water District  
Palo Verde Irrigation District  
Rainbow Municipal Water District  
Ramona Municipal Water District  
Reclamation District 2026  
Reclamation District 999  
San Dieguito Water District  
Santa Fe Irrigation District  
Scott Valley Irrigation District  
Sonoma County Water Agency  
Tulare Irrigation District  
Tulelake Irrigation District  
Valley Center Municipal Water District

# Chapter 4

## Groundwater Management Ordinances

The following counties have adopted a groundwater management ordinance. Some of the ordinances require a permit from the local Board of Supervisors before any groundwater can be exported. Before a permit to export is granted, the proponent of the groundwater export is required to satisfy the Board that the proposed export will not deplete the groundwater supply, degrade water quality, or cause land subsidence. Other counties are considering whether to adopt their own ordinance.

Butte County (Measure G)

Imperial County

Inyo County

Kern County (Emergency Ordinance)

Lake County

San Diego County

San Joaquin County

Shasta County

Tehama County

Yolo County



# Appendix A

## GROUNDWATER MANAGEMENT PLANS ON FILE WITH THE DEPARTMENT OF WATER RESOURCES

### Pursuant to AB 255

The following agencies have adopted a groundwater management plan in accordance with AB 255 and have filed a copy of that plan with DWR. The date the plan was adopted and the telephone number of the local agency are included.

Buena Vista Water Storage District—October 14, 1997, (805) 324-1101

Shafter-Wasco Irrigation District—June 8, 1993, (805) 758-5153

### Pursuant to AB 3030

The following agencies have adopted a groundwater management plan in accordance with AB 3030 and have filed a copy of that plan with DWR. The list includes the date each plan was adopted and the telephone number of the local agency. Questions about a specific management plan should be directed to that agency.

#### Alta Irrigation District

August 14, 1994, (209) 591-0800

#### Ballico-Cortez Water District

Turlock Groundwater Basin Groundwater Management Plan, November 1997, (209) 883-8428

#### Biggs-West Gridley Water District

November 15, 1995, (530) 846-3317

#### Butte Water District

May 13, 1996, (530) 846-3100

#### Camrosa Water District

April 24, 1997, (805) 482-4677

#### City of Ceres

Turlock Groundwater Basin Groundwater Management Plan, September 23, 1997, (209) 538-5789

#### City of Hughson

Turlock Groundwater Basin Groundwater Management Plan, November 10, 1997, (209) 883-4054

#### City of Turlock

Turlock Groundwater Basin Groundwater Management Plan, November 25, 1997, (209) 668-5560

#### Consolidated Irrigation District

August 5, 1995, (209) 896-1661

Chowchilla Water District-Red Top Resource Conservation District  
Joint Powers Authority Groundwater Management Plan  
December 3, 1997, (209) 665-3747

Deer Creek & Tule River Authority  
March 24, 1995, (209) 784-2598

Denair Community Services District  
Turlock Groundwater Basin Groundwater Management Plan, (209) 634-4986

Eastern Municipal Water District  
(909) 925-7676  
a. West San Jacinto Groundwater Basin—September 1994  
b. Final EIR for West San Jacinto Groundwater Basin—May 1995

Eastside Water District  
Turlock Groundwater Basin Groundwater Management Plan, September 25, 1997, (209) 491-0371

El Camino Irrigation District  
December 12, 1995, (916) 533-2885

El Nido Irrigation District  
December 31, 1997, (530) 757-6107, Ext 44

Fresno County  
March 11, 1997, (209) 262-4022

Fresno Irrigation District  
August 12, 1996, (209) 233-7161

Glenn-Colusa Irrigation District  
May 18, 1995, (530) 934-8881

Gravelly Ford Water District  
March 9, 1998, (209) 268-2483

Hills Valley Irrigation District  
Orange Cove Groundwater Management Plan, December 22, 1997, (209) 626-4461

Hilmar County Water District  
Turlock Groundwater Basin Groundwater Management Plan, (209) 632-3522

James Irrigation District  
May 7, 1996, (209) 449-2700

Kaweah Delta Water Conservation District  
August 1, 1995, (209) 747-5601

Kern Delta Water District  
October 15, 1996, (805) 834-4656

Kings River Conservation District  
Area A - April 11, 1995, Area B - March 12, 1996, Area C—August 11, 1998, (209) 237-5567

Madera Water District  
December 10, 1997, (209) 449-2700

Merced Area Groundwater Pool Interests  
(209) 722-5761 or 385-6846

Merced Irrigation District  
January 9, 1997, (209) 722-5761

Merced Irrigation District  
Turlock Groundwater Basin Groundwater Management Plan, November 18, 1997, (209) 722-5761

Modesto Irrigation District  
March 26, 1996, (209) 526-7570

Newhall County Water District  
December 12, 1996, (805) 258-3810

Oakdale Irrigation District  
September 22, 1995, (209) 847-0341

Orange Cove Irrigation District  
Orange Cove Groundwater Management Plan, December 22, 1997, (209) 626-4461

Reclamation District 787  
February 25, 1997, (530) 441-0131

Reclamation District 2035  
April 25, 1995, (530) 662-9080

Richvale Irrigation District  
December 20, 1995, (530) 882-4243

Riverdale Irrigation District  
December 6, 1995, (209) 867-3123

Root Creek Water District  
October 13, 1997, (209) 439-2598

Rosedale-Rio Bravo Water Storage District  
March 11, 1997, (805) 589-6045

Sacramento Metropolitan Water Authority  
January 15, 1993, (916) 967-7692

San Joaquin River Exchange Contractors Water Authority  
December 5, 1997, (209) 827-8616

San Luis and Delta-Mendota Water Authority-North  
April 1996, (209) 826-5155

San Luis Rey Municipal Water District  
April 17, 1996, (714) 752-8971

Santa Maria Valley Water Conservation District  
(805) 925-5212

Scotts Valley Water District  
October 13, 1994, (408) 438-2363

Shasta County Water Agency  
November 1998, (530) 225-5181

Solano Irrigation District  
February 16, 1995, (707) 448-6847

South San Joaquin Irrigation District  
February 14, 1995, (209) 948-0333

Stockton East Water District  
November 1, 1995, (209) 948-0333

Sutter Extension Water District  
August 15, 1995, (530) 673-7138

Tehama County Flood Control and Water Conservation District  
September 1998, (530) 385-1462

Tia Juana Valley County Water District  
February 7, 1995, (619) 429-6106  
a. Tijuana River Basin (Phase I)- May 1993  
b. Tijuana River Basin (Phase II) - April 1994  
c. Tijuana River Basin (Phase III) - October 1994  
d. Tijuana River Basin (Phase IV) - February 1995  
e. Tijuana River Basin (Summary Report) - May 1995

Tri-Valley Water District  
Orange Cove Groundwater Management Plan, December 22, 1997, (209) 626-4461

Truckee-Donner Public Utility District, Martis Valley Basin No. 6-67  
(Phase I), January 31, 1995, (530) 587-3896

Tulare Lake Bed Coordinated Groundwater Management Plan  
December 12, 1995, (209) 992-4127

Tulare Lake Reclamation District 761  
July 12, 1996, (209) 992-4127

Turlock Irrigation District  
Turlock Groundwater Basin Groundwater Management Plan, (209) 883-8300

Western Canal Water District  
March 21, 1995, (530) 342-5083

West Kern Water District  
April 22, 1997, (805) 763-3151



### Pursuant to Other Statutory Authority

The following agencies have adopted a groundwater management plan in accordance with statutory authority other than AB 3030 and have filed a copy of that plan with Department of Water Resources. The list includes the telephone number of the local agency. Questions about a specific management plan should be directed to that agency.

Arvin-Edison Water Storage District—(805) 854-5573

Ojai Basin Groundwater Management Agency—(805) 646-5581

Orange County Water District—(714) 378-3200

Pajaro Valley Water Management Agency—(408) 722-9292

Sierra Valley Groundwater Management District—(530) 994-3793



# Appendix B

## GROUNDWATER MANAGEMENT QUESTIONNAIRE

DWR mailed the letter and questionnaire on pages B-3 and B-4 to over 1,000 water agencies that may have statutory authority involving groundwater to obtain information on groundwater management throughout California. DWR received 650 responses to the questionnaire; that information is contained on pages B-5 through B-28. The 23 “types” of agencies that received the questionnaire are defined in the Water Code and are listed below.

### Types of Agencies with Statutory Authority to Manage Groundwater

California Water District	Municipal Utility District
Community Services District	Municipal Water District
County Sanitation District	Public Utility District
County Service Area	Reclamation District
County Water District	Recreation and Park District
County Water Works District	Sewer and Sewer Maintenance Entity
Flood Control and Water Conservation District	Water Agency or Authority
Harbor and Port District	Water Conservation District
Irrigation District	Water Replenishment District
Joint Exercise of Powers Entity	Water Storage District
Metropolitan Water District	Water Maintenance District
Municipal Improvement District	



**DEPARTMENT OF WATER RESOURCES**

1416 NINTH STREET, P.O. BOX 942836  
SACRAMENTO, CA 94236-0001  
(916) 327-1653

**NOV 14 1997**

To: California Water Purveyors

Water Code §10756, which will become effective on January 1, 1998, requires the Department of Water Resources to report to the Legislature by April 1, 1998 how many local agencies have adopted groundwater management plans, pursuant either to Assembly Bill 3030 (1992) (Water Code §10750 et. Seq.) or pursuant to some other statutory authority or juridical requirement.

For the last three years, the Association of California Water Agencies has canvassed its member agencies asking what form of groundwater management they have adopted. Not all local agencies are members of ACWA. Therefore, to prepare our report we are sending this request for information, in lieu of a fourth ACWA survey, to approximately 1,000 water agencies on our mailing list.

Please answer the questions below. To facilitate your response, you may write your answers directly on this letter and return it to us in the enclosed postage-paid envelope. Please respond no later than December 5, 1997.

1. Does your agency overlie a groundwater basin? Circle one.      Yes      No  
If yes, which basin?
2. Has your agency adopted a groundwater management plan? Circle one.  
Yes      No
3. If your agency has adopted a groundwater management plan, what authority did you use? Circle one.

AB 255 (1991 Groundwater Management)

AB 3030

Other statute (please specify which section of the Water Code)

4. If your agency has joined with other agencies, companies, or private parties to manage groundwater either by means of a memorandum of understanding, a joint powers authority or agreement, or other type of cooperative agreement, please give the name of the MOU, JPA or cooperative agreement. If not, circle No.

5. If groundwater within your agency boundaries is managed by another agency, or local entity, please list the name of that agency. If not, circle No.
  
6. If groundwater within your agency boundaries is managed in accordance with a court decision (adjudication), please give the name of the adjudicated basin as listed in the court decision, and identify the court that has jurisdiction. If not, circle No.
  
7. Does your county have a groundwater management ordinance? If yes, please list the county. Otherwise, circle No.
  
8. Is groundwater within your agency boundary managed by county ordinance?  
Circle one.    Yes    No
  
9. Does your agency overlie a groundwater basin in which the groundwater is unusable? Circle one.    Yes    No
  
10. If your agency has no interest in managing groundwater, please circle "No Interest."
  
11. Has your agency met with other agencies in the same basin to coordinate management of groundwater within the basin? Circle one.  
  
Monthly      Quarterly      Annually      Irregularly      Never

Thank you for taking the time to answer these questions. We look forward to your quick response to this query.

If you have any questions, please contact Carl Hauge at (916) 327-8861, fax at (916) 327-1648, or e-mail at [chaugc@water.ca.gov](mailto:chaugc@water.ca.gov).

Sincerely,

**ORIGINAL SIGNED BY**

William J. Bennett, Chief  
Division of Planning and Local Assistance

Enclosure

cc: Association of California Water Agencies  
910 K Street, Suite 100  
Sacramento, California 95814

## CONVERSION FACTORS

QUANTITY	TO CONVERT FROM CUSTOMARY UNIT	TO METRIC UNIT	MULTIPLY CUSTOMARY UNIT BY	TO CONVERT TO CUSTOMARY UNIT, MULTIPLY METRIC UNIT BY
Length	inches (in)	millimeters (mm)*	25.4	0.03937
	inches (in)	centimeters (cm)	2.54	0.3937
	feet (ft)	meters (m)	0.3048	3.2808
	miles (mi)	kilometers (km)	1.6093	0.62139
Area	square inches (in <sup>2</sup> )	square millimeters (mm <sup>2</sup> )	645.16	0.00155
	square feet (ft <sup>2</sup> )	square meters (m <sup>2</sup> )	0.092903	10.764
	acres (ac)	hectares (ha)	0.40469	2.4710
	square miles (mi <sup>2</sup> )	square kilometers (km <sup>2</sup> )	2.590	0.3861
Volume	gallons (gal)	liters (L)	3.7854	0.26417
	million gallons (10 <sup>6</sup> gal)	megaliters (ML)	3.7854	0.26417
	cubic feet (ft <sup>3</sup> )	cubic meters (m <sup>3</sup> )	0.028317	35.315
	cubic yards(yd <sup>3</sup> )	cubic meters (m <sup>3</sup> )	0.76455	1.308
	acre-feet (ac-ft)	thousand cubic meters (m <sup>3</sup> x 10 <sup>3</sup> )	1.2335	0.8107
	acre-feet (ac-ft)	hectare-meters (ha - m)■	0.1234	8.107
	thousand acre-feet (taf)	million cubic meters (m <sup>3</sup> x 10 <sup>6</sup> )	1.2335	0.8107
	thousand acre-feet (taf)	hectare-meters (ha - m)■	123.35	0.008107
	million acre-feet (maf)	billion cubic meters (m <sup>3</sup> x 10 <sup>9</sup> )♦	1.2335	0.8107
	million acre-feet (maf)	cubic kilometers (km <sup>3</sup> )	1.2335	0.8107
	Flow	cubic feet per second (ft <sup>3</sup> /s)	cubic meters per second (m <sup>3</sup> /s)	0.028317
gallons per minute (gal/min)		liters per minute (L/min)	3.7854	0.26417
gallons per day (gal/day)		liters per day (L/day)	3.7854	0.26417
million gallons per day (mgd)		megaliters per day (ML/day)	3.7854	0.26417
acre-feet per day (ac-ft/day)		thoudand cubic meters (m <sup>3</sup> x 10 <sup>3</sup> /day)	1.2335	0.8107
Mass	pounds (lb)	kilograms (kg)	0.45359	2.2046
	tons (short, 2,000 lb)	megagrams (Mg)	0.90718	1.1023
Velocity	feet per second (ft/s)	meters per second (m/s)	0.3048	3.2808
Power	horsepower (hp)	kilowatts (kW)	0.746	1.3405
Pressure	pounds per square inch (psi)	kilopascals (kPa)	6.8948	0.14505
	feet head of water	kilopascals (kPa)	2.989	0.33456
Specific capacity	gallons per minute per foot of drawdown	liters per minute per meter of drawdown	12.419	0.08052
Concentration	parts per million (ppm)	milligrams per liter (mg/L)	1.0	1.0
Electrical conductivity	micromhos per centimeter	microsiemens per centimeter (μS/cm)	1.0	1.0
Temperature	degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32)/1.8	(1.8 x °C) + 32

- \* When using “dual units,” inches are normally converted to millimeters (rather than centimeters).
- Not used often in metric countries, but is offered as a conceptual equivalent of customary western U.S. practice (a standard depth of water over a given area of land).
- ♦ ASTM Manual E380 discourages the use of billion cubic meters since that magnitude is represented by *giga* (a thousand million) in other countries. It is shown here for potential use for quantifying large reservoir volumes (similar to million acre-feet).

DEPARTMENT OF WATER RESOURCES  
**Division of Planning and Local Assistance**  
P. O. Box 942836  
Sacramento, CA 94236-0001

