# An Evaluation of California's Special Act Groundwater Districts

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## Authors

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# Report Organization

The report is organized into three sections. The first section is an introduction that describes the purpose of the study and includes our approach, methods, and challenges. The second section details the findings. The third section provides a description and evaluation of each Special Act District, including the reason for district formation, the district's management structure and strategies, overall groundwater level trends since district formation, and a brief summary of the key points reflective of the basin's current condition.

# LIST OF ABREVIATIONS

| | |
|---|---|
| **AB** | **Assembly Bill** |
| **ACWD** | **Alameda County Water District** |
| **ACFCWCD** | **Alameda Flood Control and Water Conservation District** |
| **AF** | **Acre feet** |
| **AFY** | **Acre feet per year** |
| **AHF** | **Above Hayward Fault** |
| **ARP** | **Aquifer Reclamation Program** |
| **ASR** | **Aquifer Storage and Recovery** |
| **BEA** | **Basin Equity Assessment** |
| **BHF** | **Below Hayward Fault** |
| **BMOs** | **Basin Management Objectives** |
| **BMP** | **Basin Management Plan** |
| **BO** | **Basin Objective** |
| **BPP** | **Basin Production Percentage** |
| **CA** | **California** |
| **Cal-Am** | **California American Water Company** |
| **CASGEM** | **California Statewide Groundwater Elevation Monitoring** |
| **CDPH** | **California Department of Public Health** |
| **CDS** | **Coastal Distribution System** |
| **CEO** | **Chief Executive Officer** |
| **CEQA** | **California Environmental Quality Act** |
| **CIMIS** | **California Irrigation Management Information Systems** |
| **CMWD** | **Casitas Municipal Water District** |
| **CRA** | **Colorado River Aqueduct** |
| **CVP** | **Central Valley Project** |
| **CVRWMG** | **Coachella Valley Regional Water Management Group** |
| **CVCB** | **Coachella Valley Groundwater Basin** |
| **CVWD** | **Coachella Valley Water District** |
| **DI** | **Direct Infiltration** |
| **DWA** | **Desert Water Agency** |
| **DWR** | **Department of Water Resources (California)** |
| **EBMUD** | **East Bay Municipal Utilities District** |
| **EBRPD** | **East Bay Regional Park District** |
| **EIR** | **Environmental Impact Report** |
| **ESA** | **Endangered Species Act** |
| **FCGMA** | **Fox Canyon Groundwater Management Agency** |
| **FY** | **Fiscal year** |
| **g/pm** | **Gallons per minute** |
| **GMD** | **Groundwater Management District** |
| **GMP** | **Groundwater Management Plan** |
| **GSA** | **Groundwater Sustainability Agency** |
| **GSP** | **Groundwater Sustainability Plan** |
| **GWRS** | **Groundwater Replenishment System** |
| **HLV** | **Honey Lake Valley** |
| **HLVGB** | **Honey Lake Valley Groundwater Basin** |

| | |
|---|---|
| **IRP** | **Integrated Resources Plan** |
| **ISGM** | **Integrated Surface Groundwater Model** |
| **JPA** | **Joint Powers Agreement** |
| **LAFCO** | **Local Agency Formation Commission** |
| **LAS** | **Lower Aquifer System** |
| **LAZ** | **Lower Aquifer Zone** |
| **LU** | **Landward Underflow** |
| **LVGB** | **Long Valley Groundwater Basin** |
| **LVGMD** | **Long Valley Groundwater Management District** |
| **M & I** | **Municipal and Industrial** |
| **MAF** | **Million Acre-Feet** |
| **MCCSD** | **Mendocino City Community Services District** |
| **MCL** | **Maximum Contaminant Levels** |
| **MCWRA** | **Monterey County Water Resources Agency** |
| **MHI** | **Median Household Income** |
| **mg/L** | **Milligrams per Liter** |
| **MPWMD** | **Monterey Peninsula Water Management District** |
| **MSL** | **Mean Sea Level** |
| **MSWD** | **Mission Springs Water District** |
| **MWD** | **Metropolitan Water District (Los Angeles)** |
| **NCGB** | **Niles Cone Groundwater Basin** |
| **NS** | **Not Simulated** |
| **NV** | **Nevada** |
| **OB** | **Outflow to Bay** |
| **OBGMA** | **Ojai Basin Groundwater Management Agency** |
| **OVGB** | **Ojai Valley Groundwater Basin** |
| **OCWD** | **Orange County Water District** |
| **PVHM** | **Pajaro Valley Hydrologic Model** |
| **PVIGSM** | **Pajaro Valley Integrated Groundwater Surface Model** |
| **PVWMA** | **Pajaro Valley Water Management Agency** |
| **RA** | **Replenishment Assessment** |
| **RAA** | **Replenishment Assessment Act** |
| **SAWPA** | **Santa Ana Watershed Project Authority** |
| **SB** | **Senate Bill (California)** |
| **SCVWD** | **Santa Clara Valley Water District** |
| **SFPUC** | **San Francisco Public Utility Commission** |
| **SGMA** | **Sustainable Groundwater Management Act** |
| **SI** | **Stream Infiltration** |
| **SLO** | **San Luis Obispo** |
| **SVGMD** | **Sierra Valley Groundwater Management District** |
| **SVLG** | **Silicon Valley Law Group** |
| **SVOC** | **Semi-Volatile Organic Compound** |
| **SWP** | **State Water Project** |
| **SWRCB** | **State Water Resources Control Board** |
| **TDS** | **Total Dissolved Solids** |
| **UAS** | **Upper Aquifer System** |
| **UAZ** | **Upper Aquifer Zone** |

| | |
|---|---|
| **UCSC** | **University of California, Santa Cruz** |
| **UCWD** | **United Conservation Water District** |
| **USGS** | **United States Geologic Survey** |
| **UWCD** | **United Water Conservation District** |
| **UWMP** | **Urban Water Management Plan** |
| **VCWPD** | **Ventura County Watershed Protection District** |
| **VOC** | **Volatile Organic Compound** |
| **WCVGB** | **Willow Creek Valley Groundwater Basin** |
| **WCVGD** | **Willow Creek Valley Groundwater District** |
| **Zone 7** | **Alameda Flood Control and Water Conservation District** |

# TABLE OF CONTENTS



# LIST OF TABLES

# LIST OF FIGURES

# INTRODUCTION

## RELEVANCE AND PURPOSE OF THE STUDY

Groundwater is a critical resource in California, providing on average 30 percent of the state's total water supply and significantly more during dry years.[1] Many communities rely exclusively on groundwater, and it is an essential back-up source of water during droughts when pumping increases significantly to compensate for reduced surface supplies.

There is no state permit system for withdrawing groundwater in California, and management programs are often developed in response to local conditions. As a result, the primary institutional arrangements that evolved to govern groundwater management are as follows:

1. Management by local agencies under authority granted in the California Water Code or other applicable state statutes. These include local groundwater management districts with authority to manage some aspect of groundwater under general powers associated with a particular type of district;[2] Special Act Districts with specially legislated authority to limit or regulate extraction; and groundwater districts with adopted plans under AB 3030.[3]
2. Local government groundwater ordinances or joint powers agreements.
3. Court adjudications where the court is generally focused on the assignment of private property rights to users.[4]

Management is often instituted after local agencies or landowners recognize a specific groundwater problem. Significant and ongoing groundwater declines in many areas of the state and concomitant negative impacts prompted the passage of the 2014 Sustainable Groundwater Management Act[5] (SGMA). The SGMA establishes new requirements for 127 basins designated as high or medium priority by the California Department of Water Resources (DWR) under the California Statewide Groundwater Elevation Monitoring (CASGEM)[6] program to utilize local institutional arrangements to form groundwater sustainability agencies (GSAs) and develop groundwater sustainable plans (GSPs) to manage the basins, along with increased state oversight. The designated basins are either in, or considered vulnerable to, overdraft.[7] The SGMA provides a framework for GSPs, and requires the DWR to create technical criteria and regulations with which to evaluate the local GSPs and their implementation.[8] In areas where groundwater users and local agencies are unable or unwilling to sustainably manage their groundwater, SGMA authorizes intervention by the State Water Resources Control Board (SWRCB).[9]

The SGMA defines sustainable groundwater management as: "The management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results." Undesirable results are defined as one or more of the following effects caused by groundwater conditions occurring throughout the basin: chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply; significant and unreasonable reduction of groundwater storage; significant and unreasonable seawater intrusion; significant and unreasonable degraded water quality; significant and unreasonable land subsidence; and depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of surface water.[10] GSAs have authority to manage local groundwater to achieve the sustainability goals, including well registration, wellhead metering, monitoring, reporting, allocating groundwater production, assessing fees, taking enforcement actions, and managing groundwater recharge, conjunctive management, changes in land use, and pumping reductions.[11]

The agencies that govern Special Act Districts are of particular interest because under the SGMA they are deemed to be exclusive local agencies within their statutory boundaries and they have the option to be the sole GSA in their service area boundaries. As such, they are one of the state's possible routes towards sustainable groundwater management.[12] Special Act Districts are created when the legislature passes an act that authorizes their creation and local authorities elect to create the district. The enabling legislation of each Special Act District provides the authority to limit or regulate extraction and manage groundwater to meet specific local needs.

Given the role of the SWRCB in the SGMA intervention going forward, this report provides information on each Special Act District's statutory authority and mandates to manage groundwater, the ability to utilize their legislated authority to sustainably manage their groundwater basin, and key elements that could be of assistance to other districts forming GSA's under the SGMA.

This report is organized in three sections: (1) an introduction, (2) a discussion of findings, and (3) a summary of the 15 Special Act Districts designated in SGMA and their differing levels of statutory authority, management strategies, and challenges. The objective is to better understand key elements that can promote sustainable management of a groundwater basin.

## RESEARCH APPROACH

Key issues evaluated for this report are whether management by a Special Act District results in: overdraft conditions and impacts that are reduced or eliminated over the long term; a well-defined management structure that includes annual monitoring of groundwater conditions in the basin; and strategies that promote long-term sustainable management of the basin. Each Special Act District review concludes with a discussion of the challenges and successes in aligning with SGMA's goals of sustainable groundwater management.

Each Special Act District review summarizes:

1. Hydrogeology, land use, district size, and population of the basin
2. Reason for the formation of the Special Act District
3. District capabilities as defined in the enabling legislation and amendments
4. Revenue sources
5. Management structure for the governing body
6. Management strategies over time
7. Metering, monitoring, and reporting of groundwater withdrawals and groundwater levels
8. Whether and how safe yield and overdraft are defined and determined
9. Annual and long-term extractions
10. Whether management resulted in halting or reversing existing overdraft and associated negative impacts

## RESEARCH CHALLENGES

Several research challenges were encountered during collection of data for this report, including the following:

- *Unavailability of Information*
  The legislature created two Special Act Districts—Honey Lake Valley and Long Valley—that were never activated and had no websites, limiting the available information. Two districts—Willow Creek Groundwater Management Agency and Mono-County Tri-Valley Groundwater Management District—have no websites and limited access to public documents and reports.

- *Overlapping jurisdictions*
  Two Special Act Districts are part of a larger area managed by another water agency; Mono-Tri Valley – Owens Valley Groundwater Basin, and Desert Water Agency (DWA) – Coachella Valley Groundwater Basin. This allows for collaborative management, but understanding the current condition of the smaller basin was challenging.

- *Safe yield*
  Basins use a variety of metrics to manage their basin, and definitions and calculations of safe yield are often not utilized.

## RESEARCH METHODS

The authors reviewed existing literature and archival sources including: enabling legislation for each district; federal, state, and local agency reports; consultant reports; media; and academic and trade journals. They also conducted telephone interviews with individuals managing a Special Act District and consultants who provided annual reports or participated in developing management plans. Each district report was reviewed by a stakeholder in the basin, generally a director or manager of the district, or a technical expert. A triangulation of data sources was utilized to provide a systematic analysis of patterns.

This report was prepared for the SWRCB, and includes the specific scope of work authorized by the board. Limitations of the study include the limited time allotted for this project, the unavailability of some information, and conflicting accounts of district issues.

## RESEARCH TEAM

Our research team is a group of interdisciplinary scholars primarily from the University of California, Santa Cruz (UCSC) under the direction of Dr. Ruth Langridge. Research, ongoing since 2010, highlights the need to assess the social, environmental, political, and economic factors impacting equitable and effective groundwater management across the state. UCSC graduate student Stephen Sepaniak and Stanford postdoctoral scholar Esther Conrad are co-authors of this report.

# FINDINGS

Special Act Districts vary in location (Figure 1), as well as in size, population, land use, management structures and management strategies. They exemplify the social, institutional, and physical diversity that characterize California's local groundwater basins.

**Figure 1: Special Act Districts Map**


Abbreviations:
CSD - community services district
FCWC - flood control and water conservation
GMA - groundwater management agency
GMD - groundwater management district
WA - water agency
WD - water district
WMA - water management agency
WMD - water management district

Under the SGMA, Special Act Districts are deemed to be exclusive local agencies within their statutory boundaries, and they have the option to be designated as the sole GSA in their service area boundaries. As such they can serve as a window into the challenges and successes of managing groundwater within the act's framework.

The central findings are as follows:

- ***Although the enabling legislation for each Special Act District provides some authority to limit or regulate extraction, generating outcomes that reflect SGMA sustainability goals is uneven.***

- ***A major land use trend is the shift from agricultural use to municipal development.***

- ***Municipal districts were generally more successful over time in developing diverse strategies to improve groundwater conditions. Success is correlated with their access to imported water and multiple revenue streams, as well as the social and political goals of the basin's water users and management.***

- ***Many districts, including the large municipal districts, are very reliant on imported water from state and federal projects to prevent overdraft. As imported water becomes more expensive and less reliable in the future, these districts are aggressively exploring alternative supplies, but some may need to consider more comprehensive demand management approaches.***

- ***A major challenge for the two predominantly agricultural districts is to reduce their overdraft without imported water. Given the increased unreliability and cost of imported water, these districts have an opportunity to provide examples of approaches that can result in sustainable management without additional imports, including more comprehensive demand management strategies.***

# Basin Characteristics and Sustainable Management

***Basin outcomes are related to multiple factors, including land use and population; management structures and capabilities in enabling legislation and amendments; the basin hydrogeology; stakeholder goals; revenue sources; water portfolio; supply strategies; demand management and monitoring: implementation of a water budget; storage goals; and strategies to reduce overdraft.***

## Land Use and Population

***As illustrated in Table 1, Special Act Districts exemplify the wide range in population and land use that characterize California's groundwater basins.***

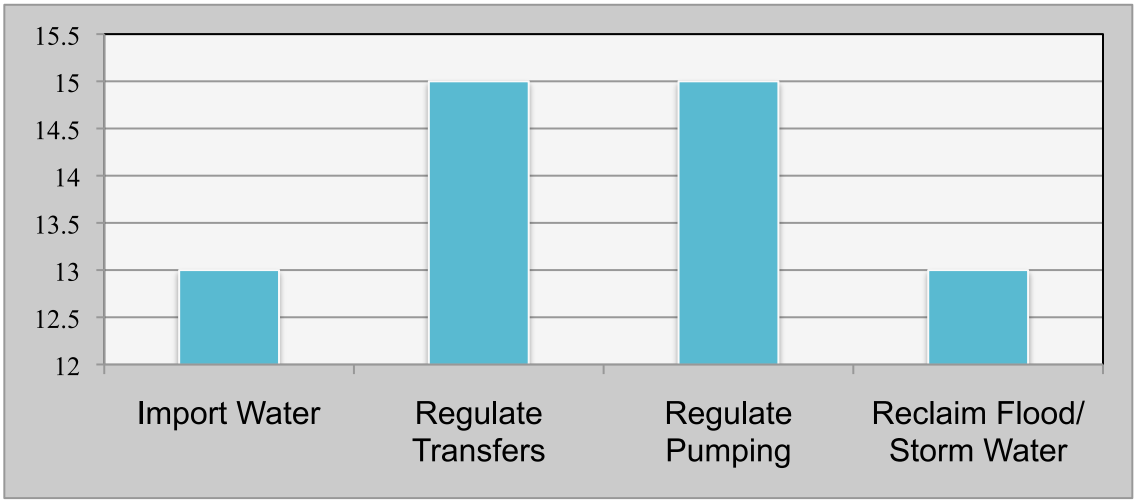
**Table 1: Population and Land Use** (**Municipal, Small Residential, Predominantly Agriculture, Mixed Use**)

| Special Act Water District | Population | Dominant Land Use |
|---|---|---|
| Orange County Water District (OCWD) | ~2.4 million | Municipal and industrial[13] |
| Santa Clara Valley Water District (SCVWD) | ~1.8 million | Municipal, some agriculture in south[14] |
| Alameda County Water District (ACWD) | ~343,500 | Municipal, commercial, and industrial[15] |
| Alameda County Flood Control and Conservation Water District (Zone 7) | ~220,000 | Municipal[16] |
| Monterey Peninsula Water Management District (MPWMD) | ~104,130 | Municipal, industrial, and some agriculture[17] |
| Desert Water Agency (DWA) | ~71,000 | Municipal (Palm Springs), resorts, golf |
| Mendocino City Community Services District (MCCSD) | ~1,000 | Individual residential - small town[18] |
| Fox Canyon Groundwater Management Agency (FCGMA) | ~700,000[19] | Agriculture with multiple municipalities[20] |
| Pajaro Valley Water Management Agency (PVWMA) | ~114,250 | Agricultural, some municipal (Watsonville)[21] |
| Ojai Groundwater Management Agency (OGMA) | ~8,260 | Agriculture and municipal[22] |
| Tri-Valley Groundwater Management District (TVGMA) | ~954 | Mixed-use – rural[23] |
| Honey Lake Valley Groundwater Management District (HLVGMD) | ~23,570 | Mixed-use – rural[24] |
| Long Valley Groundwater Management District (LVGMD) | ~46,840 | Mixed-use – rural[25] |
| Sierra Valley Groundwater Management District (SVGMD) | ~2,200 | Mixed use – rural[26] |
| Willow Creek Groundwater Management District (WCGMD) | NA | NA |

## Enabling Legislation

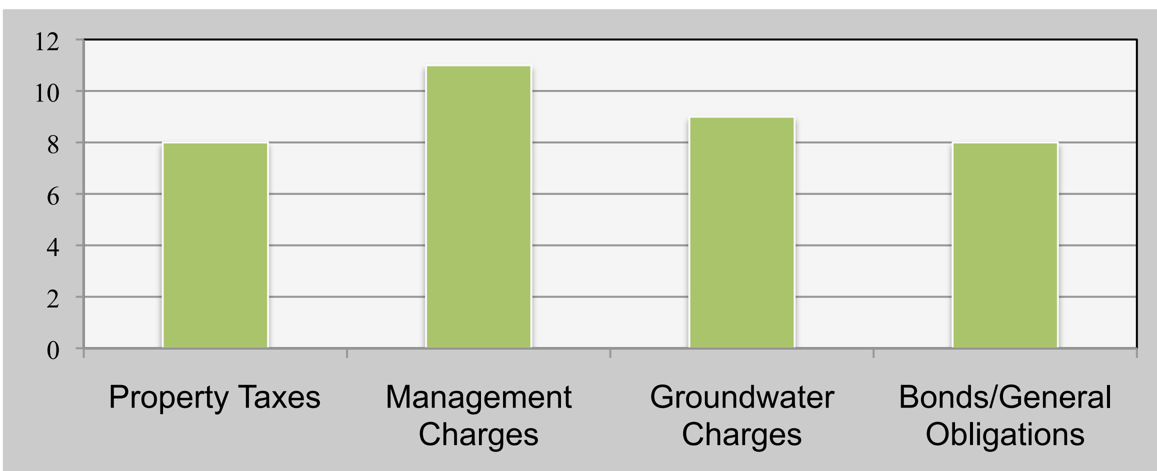
***Enabling legislation provides each district with specific management and fundraising capabilities (Figures 2 and 3, but each district exercises their authority differently).***

**Figure 2: Management Capabilities in the Enabling Legislation***




* y axis represents the number of basins

**Figure 3: Fundraising Capabilities in the Enabling Legislation**




* y axis represents the number of basins

## Revenue Sources

***The main sources of revenue are from municipal and industrial water sales and property tax revenues. Large districts generally have more varied revenue streams.***

The ACWD, viewed in Table 2, is an example. While ACWD can draw on a more varied set of revenue streams, fees for providing water to users and property tax revenues comprise nearly 93 percent of its total operating budget of close to $400 million.

**Table 2: ACWD Revenue Sources**

| Revenue Source | |
|---|---|
| Customer Fees | Charges for providing water to municipal and industrial users |
| Property Taxes | Roughly 8% in FY 2015/16 |
| Facilities Connection | Fees for establishing new connections to ACWD's distribution system |
| Investment Income | Revenues from financial investments |
| Fees and Rentals | Fees from short-term rentals of equipment, such as hydrant meters |
| Other Revenues | A very small share of the total budget. Includes permitting fees collected for well construction and modification |

## Hydrogeology

***Hydrogeologic characteristics affect management strategies.***

The Mendocino Headlands Aquifer is the sole source of water for the MCCSD. It is heavily dependent on annual precipitation, and during wet years the existence of shallow groundwater at certain locations results in groundwater discharge to surface drainages rather than remaining in storage. In dry years, storage tanks can become depleted by late summer. In response to these physical conditions, the MCCSD has one of the most conservation-focused strategies in the state, including aggressive drought rationing, restrictions on non-essential uses, a groundwater extraction permit ordinance and an agreement with Mendocino County to regulate groundwater extractions.

## Reason for District Formation

***"Sustainable" groundwater management was not specified in the enabling legislation for any Special Act District, and only some districts were tasked with overall groundwater management.***

Some older Special Act Districts were established for flood control and to provide water for municipalities, as well as to ensure local control of water.

ACWD and Zone 7 were formed because of pressures to give residents more control over their local water resources and halt water exports. Groundwater management and replenishment become central to the districts' activities decades after inception.

MCCSD was established to oversee operation of a wastewater treatment plant. Currently it has authority to regulate groundwater withdrawals from residential wells within its service area.

SCVWD's early focus was on reservoir construction for flood control and conservation purposes. The district began groundwater recharge in 1969, many years after its enabling legislation.

Newer Special Act Districts were generally established for the express purpose of managing local groundwater basins, but two of the older, larger full-service districts were established with overall groundwater management as one of several stated policy goals.

The DWA and the OCWD were both created, in part, to protect the resources of the local groundwater basins within the district's boundaries. Initially, both districts focused on augmenting storage capacity and importing water for beneficial uses. Current strategies encompass the broader goal of sustainable groundwater management and include recharging and protecting the existing groundwater basins.

***Seawater intrusion due to declining groundwater levels prompted community concerns in some basins, and were catalysts for district formation.***

Districts with concerns relating to seawater intrusion at the time of formation include FCGMA, PVGMA, OCWD, ACWD, and MPWMA.

***Concerns about water exports led to district formation in some communities.***

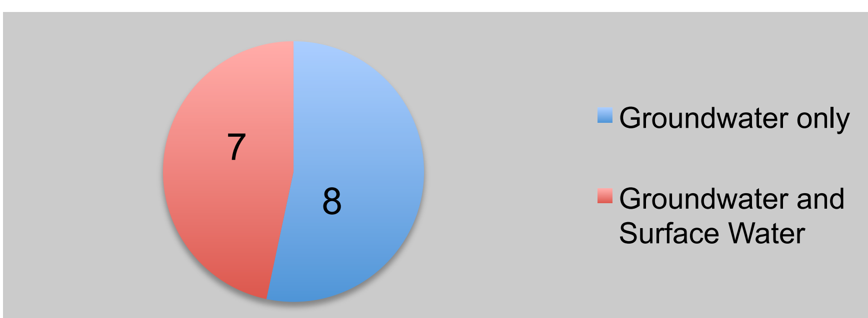
Some districts were established to halt water exports. Seven of the 15 enabling acts specifically prohibit water export outside of the district service area. In the Sierra foothills, a concern over water leaving the county prompted special act formation and county ordinances restricting exports.

Portions of the LVGB in Lassen and Sierra County, and the HLVGB in Lassen County, underlie Washoe County, Nevada. Groundwater users in these basins, along with groundwater users in the Sierra Valley Basin, were concerned that the drilling of large wells on the Nevada side of Long Valley near Bordertown would result in these basins being overdrafted, prompting the formation of the Special Act Districts.

## Water Sources

***Eight districts are entirely reliant on groundwater, as illustrated in Figure 4. These face greater challenges with respect to the sustainable management of their basin.***

**Figure 4: Water Supply Sources**



## Water Provision

***Five Special Act Districts provide water for consumptive use, as illustrated in Table 3. Water provision for consumptive use can affect district priorities and management.***

**Table 3: Water Provision**

| Special District | Population | Water Provision |
|---|---|---|
| OCWD | ~2.4 million | Water wholesaler |
| SCVWD | ~1.8 million | Water wholesaler[1] |
| ACWD | ~344,000 | Full service[2] |
| ACFCCD, Zone 7 | ~220,000 | Wholesaler[3] |
| DWA | ~71,000 | Retail provider[4] |
| MPWMD | ~104,000 | No water provision[5] |
| MCCSD | ~ 1,000 | No water provision |
| FCGMA | ~700,000 | No water provision[6] |
| PVWMA | ~114,000 | No water provision[7] |
| OGMA | ~8,300 | No water provision |
| TVGMD | 954 | No water provision |
| HLVGMD | ~23,600 | No water provision |
| LVGMD | ~46,800 | No water provision |
| WCGMD | NA | No water provision |
| SVGMD | NA | No water provision |

[1] For smaller retailers within service area.
[2] The agency operates a full network of pipes, pumps, reservoirs, and water treatment facilities.
[3] To multiple retailers located within service area.
[4] Residential/commercial - Shares management of groundwater basins with older, larger Coachella Valley Water District.
[5] Coordinates joint projects with Cal-Am, which supplies 95% of the potable water within the district service area.
[6] But it coordinates with seven municipal purveyors that have service areas that partially overlap FCGMA.
[7] Supplies retail water to some areas affected by saline intrusion through its recycled water partnership with the City of Watsonville.

The SCVWD took on the responsibility of water provision after it was established. Today, it serves as a wholesaler to 12 water retailers that provide water for municipal and industrial uses. Regulations and rates vary between SCVWD's two distinct zones; Zone W2 includes the heavily urbanized Silicon Valley where more than 99 percent of all water is supplied via public water retailers who purchase water from SCVWD and then sell that water to municipal and industrial (M & I) consumers through their distribution system.

The OCWD's enabling act focused on protecting the groundwater basin from seawater intrusion. Today, it is a full-service district engaging in a range of other management and wholesaling activities.

The DWA's initial focus was on the importation of supplemental surface water to meet local demand, including reservoir construction for storage and negotiations with other public entities to increase its allocation of imported Colorado River water. In 1973, DWA began using the imported water to replenish the underlying basins. In 1968, the DWA purchased the Palm Springs and Cathedral City water companies, taking on retail water distribution.

Several districts do not own or operate infrastructure to deliver water for consumptive use and focus on other management issues, as illustrated in Table 4.

**Table 4: District's Primary Activities**

| District | Primary Activities |
|---|---|
| MPWMD | Recent activities include working with partners to develop alternative water sources including desalination. |
| MCCSD | Groundwater management and conservation. |
| FCGMA | Addressing seawater intrusion. Does not own or maintain any water distribution infrastructure, and wells regulated by district tend to be privately owned and operated. |
| PVWMA | Reducing seawater intrusion. Provides recycled water for irrigation through a coastal distribution pipeline. |
| OGMA | Groundwater management, with the district employing conjunctive management strategies to recharge its aquifers. |
| SVGMD | Groundwater management. |

## Management Goals

***While enabling legislation defines a district's authority, documents and policy statements reveal a district's groundwater management goals. Whether or not these are focused primarily on sustainable groundwater management strategies varies.***

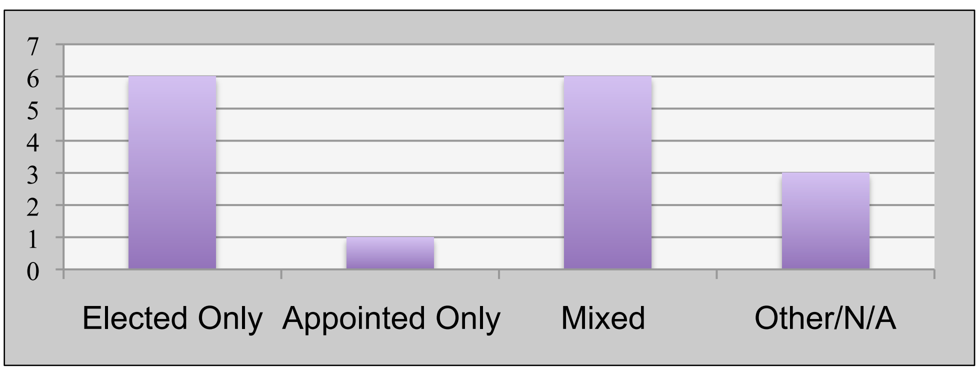
ACFCCD, Zone 7, maintaining a philosophy that new development should pay for water system expansion, adopted hook-up and flood control fees for new homes, using the revenues to fund further water storage, water conveyance, water treatment, and water quality infrastructure. Using imported SWP water as the primary source of supply, Zone 7 emphasized increasing groundwater storage, making it one of the few districts in California to use its groundwater primarily as a drought reserve. This enabled it to weather the drought of the late 1970s, without resorting to water rationing. Increasing groundwater storage capacity continues to remain a central focus, including the gradual conversion of former limestone quarries across the Valley into a series of artificial recharge lakes.

The DWA (very high per capita water use) is the water utility for the rapidly growing Palm Springs area in the Coachella Valley. It was created to protect the resources of its local groundwater basin, but in its documents and policies, it highlights the goals of maintaining reliable and cost-effective water supplies for its customers and ensuring future economic growth. In line with this, DWA initially emphasized augmenting storage capacity and importing water, and less attention was given to sustainable management. Over time, DWA expanded its goals to include conservation.

## Management Structure

The Board of Directors can be appointed, elected by all voters in the district or just by property owners, or a hybrid variation. The structure of the board can influence decisionmaking for managing the basin.

**Figure 5: Composition of the Governing Body**



OCWD – **Hybrid:** The 1933 enabling legislation established a seven-member Board, with each member representing a division within OCWD. Since funding came from an ad-valorem property tax, voting was weighted by property value. By the 1950s, urban development began to overtake agriculture, and in 1953, Board membership was expanded to include the cities of Anaheim, Fullerton, and Santa Ana, who were groundwater users, but had been previously excluded because their voters were already paying to import water from MWD. These cities appoint their Board members rather than electing them. In 1967, an amendment to the Act changed voting in the seven original divisions so each registered voter had one vote and three are now appointed by the cities.

FCGMA – **Appointed** by various stakeholder groups, which includes some public agencies whose representatives are elected.

MPWMD and PVWMA – **Hybrid:** Board of Directors has a majority of elected members, and a minority of appointees representing existing political entities within their service area.

SCVWD, ACWD, Zone 7, DWA, MCCSD – **Elected by registered voters** within the service area.

WCGMD – **Elected by landowners:** Owners of land with extraction facilities capable of producing more than 100 gpm are granted one vote per acre of owned land irrigated by a well capable of producing greater than 100 gpm. No voter can possess more than 50% of the total votes.

## Management Strategies

### *Imported Water*

***Many districts, including the large municipal districts, rely heavily on imported water for consumptive use and as a strategy to reduce or halt groundwater level declines and associated impact, as illustrated in Table 5.***

**Table 5: Imported Water as a Supply Source**

| | Special Districts | Population |
|---|---|---|
| Imports Water | Alameda Zone 7, ACWD, OCWD, SCVWD, OGMA*, SVGMD**, DWA*** | 8,258 to 2.4 million |
| Does Not Import Water | Monterey Peninsula WMD, Mendocino City CSD, Fox Canyon GMA****, Pajaro Valley WMA, Tri-Valley GMD, Long Valley GMD, Honey Lake Valley GMD, Willow Creek GMA | 954 to 104,129 |

* OGMA imports water from the Casitas Municipal Water District.
** SVGD imports about 6,000 acre-feet per year (AFY) from the Little Truckee River for irrigation.
*** DWA receives SWP water by exchanging Colorado River water for SWP water with the MWD.
**** FCGMA does not import water, but several municipal and agricultural entities use both groundwater and imported SWP water. Return flows from this imported water provide significant recharge to the groundwater basin.

Reducing groundwater level declines and seawater intrusion without imported water has been challenging for the two large agricultural districts: PVWMA and FCGMA.

### *Withdrawals and Replenishment*

***All Special Act Districts have some authority to regulate withdrawals and incentivize replenishment, but not every district utilizes this authority, and approaches vary.***

Enabling legislation generally provides some authority to regulate withdrawals, as illustrated in Table 6, but most districts focus on supply side strategies to manage their basin.

**Table 6: Strategies to Reduce Withdrawals**

| Special District | Regulate Withdrawals |
|---|---|
| OCWD | Limited restrictions. Uses a replenishment fee. |
| FCMGA | Charges a modest extraction fee based on crop type. |
| Zone 7 | Sells imported water to retailers who also pump groundwater but have a fixed annual quota that if exceeded requires a recharge fee. |

Many districts use a replenishment fee, but there is variation in how that is implemented. All rely on some conservation measures and curtailing use during drought.

OCWD – Uses a replenishment fee proportional to pumping.

Zone 7 – Retailers receiving water from Zone 7 also pump groundwater, but have a fixed annual quota which if exceeded requires them to pay a recharge fee.

FCGMA – Uses crop-type allowances and charges an extraction fee.

OBGMA – Uses an irrigation allowance chart per crop type for agricultural users who are required to adhere to guidelines on how much water can be used per crop per acre.

MCCSD – No imported water. Enforces strict conservation rules to reduce demand.

## City and County Ordinances and Water Exports

While the enabling legislation for eight Special Act Districts has limitations on water exports, cities and counties can also regulate water exports with ordinances, and several counties that contain Special Act Districts have enacted such ordinances, affecting district management, as illustrated in Table 7.[27]

Sierra County was one of the earliest to adopt an ordinance out of concern for the "mining" of groundwater. The county has an "out-of-basin" restriction and has also enforced a permitting process for within-county use.[28] The potential for groundwater exports to Nevada was the issue in Lassen and Sierra Counties. In Mono and Inyo Counties, concerns were projects to export groundwater to Los Angeles. The 2014 urgency ordinances in Ventura County and the City of Ojai were related to drought conditions, rapid depletion of county groundwater resources, and concerns over future SGMA compliance. The county ordinance indefinitely prohibited the issuance of permits for construction of new water wells or modification or repair of existing wells in unincorporated areas until a basin was found not to require a Groundwater Sustainability Plan (GSP) or, in basins where a GSP was required, a GSA has adopted a GSP.[29] The City of Ojai passed a nearly identical urgency ordinance prohibiting issuance of permits for construction of new water wells or modification or repair of existing wells in the city's boundaries.[30] As already indicated, the enabling legislation of many Special Act Districts also prohibits water exports.

**Table 7: City and County Ordinances[31]**

| County or City with a Special Act District | Ordinance |
|---|---|
| Monterey County (1993) (MPWMA) | Applies only to zones not already covered by the MCGMA. |
| Mendocino County (1995) (MCCSD) | On-site groundwater use restrictions. Applies to City of Mendocino. |
| Sierra County (1977, 1997) | Out-of-basin restrictions and a permitting process for in-county use. |
| Inyo (1980) and Mono Counties (1988, 1998) (TVGMD),<br>Lassen County (1999) (WCGMD, LVGMD and HLVGMD | Export restrictions.* |
| Ventura County and the City of Ojai (2014) (OGMA) | Urgency ordinance prohibits issuance of permits for new water wells or modification of existing wells in unincorporated Ventura County. |

* In 1998, Inyo County adopted Resolution #1004 to govern sales and transfers of groundwater to another groundwater basin or outside of the county, including sales and transfers to Los Angeles by another party. Los Angeles' operations are exempt from #1004.

### Metering, Monitoring, and Reporting of Withdrawals

***Public supply wells are generally metered and monitored. Metering of agricultural and individual user wells varies and production is often self-reported.***

In areas dominated by agriculture, irrigation allowances by crop type are common. Amounts are often established on a per-crop basis but can vary depending on pumper location and the past year's precipitation. When existing farmland is converted to thirstier, higher profit margin crops, total water use can increase, but this does not necessarily alter the total per crop irrigation allowance. Metering and monitoring are illustrated in Table 8.

**Table 8: Metering and Monitoring**

| Special District & Population | Metering and Monitoring |
|---|---|
| OCWD 2.4 million | ~ 200 large-capacity wells (97 percent of all production) must be metered and extractions reported annually. OCWD also maintains over 400 monitoring wells and collects samples from ~200 private and public supply wells for water quality assessment. |
| SCVWD 1.8 million | Over 83 percent of groundwater produced within the district is withdrawn by public supply wells, which are subject to stringent metering and district monitoring. Privately owned agricultural wells and non-agricultural wells also have metering requirements. |
| ACWD 343,499 | Water meters are installed on most wells. Comprehensive regulations require permitting and inspections for all wells. |
| Zone 7 220,000 | Primarily monitored by public water agencies who supply water to municipalities. Private groundwater production for irrigation has monitoring requirements and Zone 7 monitors production of more than 225 wells in the Main Basin. It has a comprehensive database of historical groundwater levels. |
| MPWMD 104,129 | Metering is required on all wells and MPWMD monitors groundwater elevations. Well owners are required to report annual extractions. California American Water Co., responsible for over 75 percent of groundwater production in the district service area, reports well data monthly. In Seaside Basin, MPWMD conducts monitoring on behalf of the Watermaster. |
| DWA 71,000 | The agency's public supply system wells are all metered and subject to routine monitoring requirements for groundwater elevation and water quality. Private producers who withdraw less than 10 AFY are exempt from pumping regulations. |
| MCCSD ~1,000 | ~ 60 percent of all wells are metered. Residents are responsible for self-monitoring their own wells, but well construction, modification, or alteration requires permit applicants to prove that the approval of their project will not negatively impact groundwater elevations in wells within district service area. |
| FCGMA 700,000 | All well operators are required to self-report their groundwater extraction on a semi-annual basis using an agency provided Semi-Annual Extraction Statement (SAES). Ordinances have mandated flow meters on all wells (except for domestic wells). |
| PVWMA 114,252 | Mandatory metering and reporting requirements exist for many large-scale wells that are monitored by the district. |
| OBGMA 8,258 | Public water suppliers meter and monitor their wells. All large volume well operators are required to report annual extractions and metering is required on all new wells. Irrigators are subject to regular inspections to check compliance and accuracy in reporting crop totals. |
| SVWD 2,196 | 34 wells monitor quantity and 15 monitor quality.[32] Landowners are required to purchase a meter for every well that exceeds a flow rate of 100 gpm.[33] The district collects data monthly. |
| LVGMD, 46,836 | NA |
| HLGMD, 23,566 | NA |
| TVGMD, 954 | NA |
| WCGMA, NA | NA |

## Safe Yield and Overdraft

Special Act Districts use a variety of metrics to manage their basin.

MCCSD – Because the Mendocino Headlands aquifer is an open system, the safe yield is highly variable and depends on annual rainfall patterns. Therefore, the rate at which water can be withdrawn perennially without producing a long-term decline in water levels, is the important metric, as issues can arise if pumping exceeds this perennial yield.

OCWD – No safe yield has been established for the Orange County Basin. Instead, the process that determines a sustainable level of pumping considers this basin's safe operating range as well as basin storage conditions, water demands, and the amount of recharge water available to the District. The basin is managed to avoid groundwater elevations dropping to levels that result in negative or adverse impacts. These include chronic groundwater levels indicating a significant and unreasonable depletion of supply if continued over the long-term, increased seawater intrusion, significant and unreasonable land subsidence that substantially interferes with surface land uses, and increased pumping costs.[34] OCWD has also detailed the benefits and constraints of different levels of accumulated overdraft.

OBGMA – The Ojai Basin is heavily dependent on annual precipitation patterns and may be substantially less in critically dry years. OBGMA establishes basin storage thresholds that, if exceeded, trigger special action by the OBGMA to assure the protection of groundwater supplies. OBGMA develops the triggers and the conservation measures that must be implemented at these points.

ACWD – The annual rate of recharge is estimated in a year where precipitation totals come close to their historical averages. The annual overdraft is defined in ACWD's Replenishment Assessment Act as the difference between the amount of pumping of groundwater from the basin and the amount of water recharged from local water supplies for the fiscal year. The net local water recharged to the groundwater basin is composed of the portion of applied water (e.g., irrigation) and rainfall that percolates to the groundwater basin, plus the portion of watershed runoff impounded at the recharge facilities, less evaporation of such impounded water, and less saline and other outflows from the basin. Overdraft is compensated for by recharge with imported water.

FCGMA – There are seven distinct groundwater basins within FCGMA's boundaries, and there is no specific safe yield value for each individual basin. Rather than relying on safe yield values to assess whether the Agency is meeting its goals, the FCGMA sets annual Basin Management Objectives (BMOs) for water levels and water quality in each of the basins and aquifers within its boundaries. Water level targets serve as the primary indicator for assessing whether the FCGMA has met its goals at each of its monitoring sites. The overall goal is to balance the rate of replenishment (supply) with the rate of extraction (demand) in the aquifers under the Agency's purview.

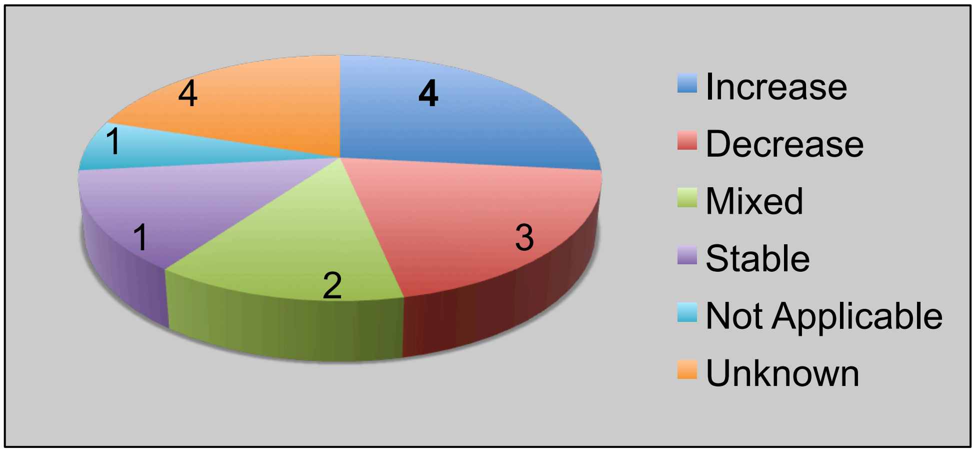
SCVWD – The district does not identify a "safe yield" but balances pumping with managed and in-lieu recharge programs, as well as water conservation and recycling.

Groundwater level trends in each basin are illustrated in Table 9 and as a graph in Figure 6.

**Table 9: Condition of the Basin**

| Special District | Population | Import Water | Long-term Groundwater Level Trends |
|---|---|---|---|
| OCWD<br>*Municipal, industrial* | 2.4 million | Yes | ***Increase*** – Levels in the Forebay Area, once the most threatened portion in the aquifer have increased since the mid-twentieth century, but levels elsewhere have dropped. |
| SCVWD<br>*Municipal/some agriculture* | 1.8 million | Yes | ***Increase*** – While groundwater pumping exceeds the rate of natural recharge, imported water from the SWP and CVP and recycled water have contributed to higher groundwater levels across both sub-basins. |
| ACWD<br>*Municipal, industrial* | 343,499 | Yes | ***Increase*** – GW levels are much higher today than in the recent past. The District is dependent on SWP water, but there is increased reliance on local surface water and a new desalination facility. |
| ACFCCD, Zone 7<br>*Municipal* | 220,000 | Yes | ***Increase*** – GW levels in the Livermore-Amador Basin are substantially higher today than they were a generation ago, with imported water and increasing amounts of artificial recharge. |
| MPWMD<br>*Municipal, some agriculture* | 104,129 | No | ***Decrease*** – Despite recent efforts to reduce the rates of groundwater pumping and increase the rate of artificial recharge of the Seaside Groundwater Basin, overdraft remains a perennial concern across MPWMD service area. |
| DWA<br>*Municipal (Palm Springs)* | 71,000 | Yes | ***Mixed*** – Aquifers are shared with the CVWD, where most pumping occurs. Colorado River water and exchanges with the MWD for SWP water helped GW levels rise across most sub-basins of the Coachella Valley, but levels declined during drought, and in 2015 are in overdraft. |
| MCCSD<br>*Municipal, small town* | ~ 1,000 | No | ***Not Applicable*** – Mendocino Headlands' winter inflows discharge into the Pacific Ocean through porous rock formations, restricting the open aquifer system from storing water over extended periods. |
| FCGMA<br>*Agriculture/ some municipal* | 700,000 | No | ***Mixed*** – During some wet years, groundwater production was close to recharge, but in dry to moderate rainfall years, extraction rates exceed the rate of recharge. Current rates of extraction exceed the rate of recharge by about 50 percent. However, this is for all seven basins within FCGMA service area, and not all basins have been affected equally. |
| PVWMA<br>*Agriculture/ some municipal* | 114,252 | No | ***Decrease*** – Groundwater levels are now 10–20 feet below sea level across much of the Basin, but the rate of seawater intrusion has slowed. |
| OGMA<br>*Agriculture/ some municipal* | 8,258 | Yes | ***Stable*** – The availability of imported water from the neighboring Casitas Municipal Water District has helped stabilize groundwater levels in recent years. |
| SVGMD<br>*Mixed use/rural* | 2,196 | Yes | ***Decrease*** – Levels recovered during the 1990s after over a decade in decline, but have fallen again in recent years. |
| HLVGMD<br>*Mixed use/rural* | 23,566 | No | ***NA*** |
| LVGMD<br>*Mixed use/rural* | 46,836 | No | ***NA*** |
| TVGMD<br>*Mixed use/rural* | 954 | No | ***NA*** |
| WCGMD<br>*Mixed use/rural* | NA | No | ***NA*** |

**Figure 6: Number of Basins and Long-Term Groundwater Level Trends**




## Highlighting Sustainable Management Strategies

PVWMA – In March 2016, the Board of Directors approved an innovative Recharge Net Metering pilot program, in conjunction with the University of California, Santa Cruz, and the Resource Conservation District of Santa Cruz County to incentivize managed aquifer recharge. Project partners plan to work with about 10 willing landowners to improve the capture of runoff and carry it to basins where it can refill the aquifers below. In exchange they will receive a rebate that will be a percent of the cost that the PVGMA charges for pumping water.[35]

MCCSD – Residents are required to apply for permits to extract groundwater for a new development, expanding any existing use of groundwater, and any change in use of groundwater, or constructing or modifying a well within the District service area. Additional hydrologic studies and aquifer test procedures are mandated before a permit is issued, and applicants must first prove that there is adequate groundwater in the proposed well site for beneficial use, without negatively impacting water levels in other test wells within District boundaries.

OCWD – The Orange County Groundwater Basin is operated to continuously fluctuate within a carefully calculated safe operating range that is determined using basin storage conditions, water demands, and the amount of recharge water available to the OCWD. The goal is to avoid groundwater elevations dropping to levels that result in negative or adverse impacts.

## Future Challenge

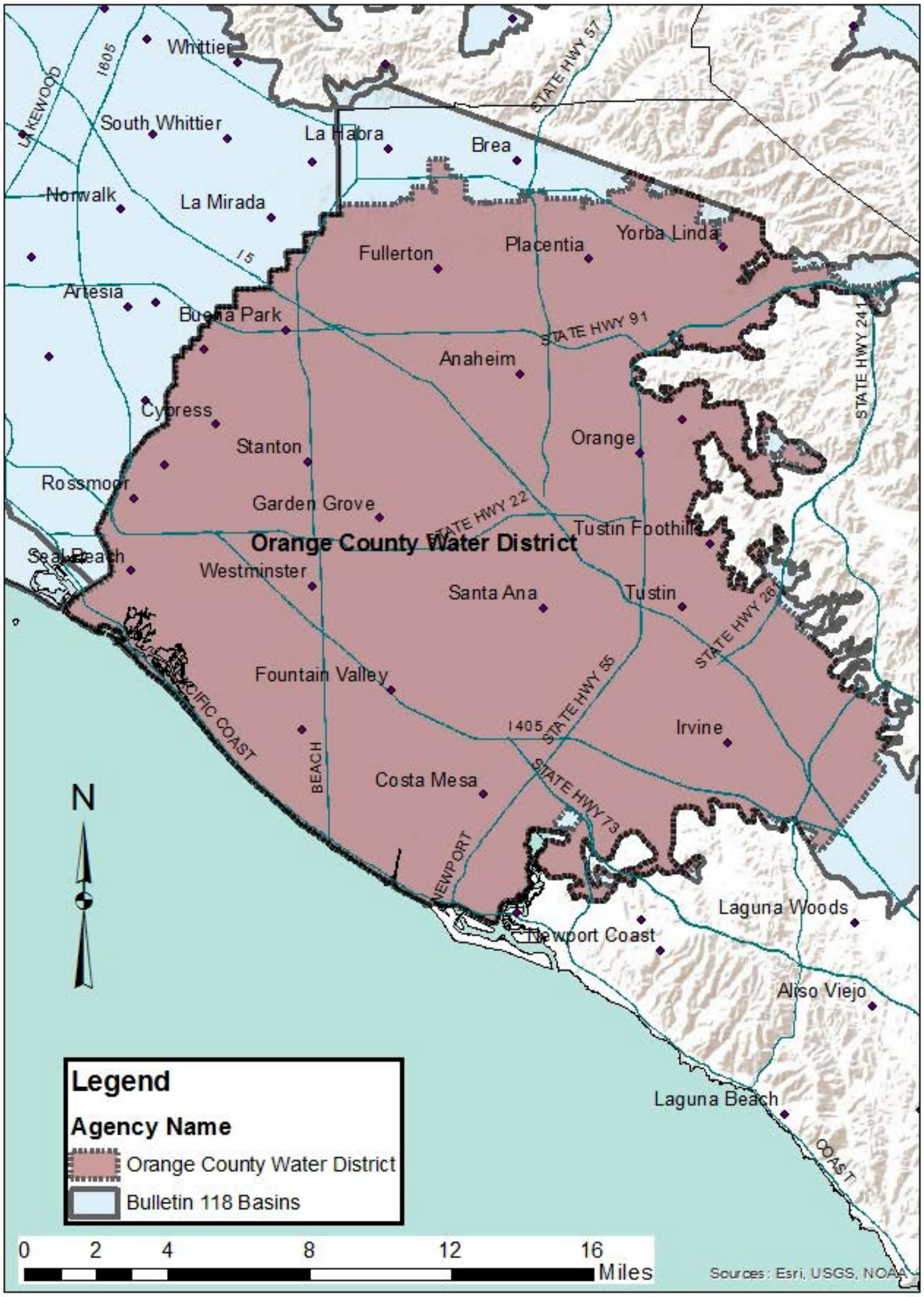
***Many districts, including all the major municipal districts, have an insufficient quantity of local supply to meet local demand, and they rely significantly on imported water to grow and sustain their basin. While actively seeking additional sources of supply, preventing groundwater level declines may be more challenging in the future as imported water becomes more expensive and less available, and droughts are more frequent and intense under climate change. More comprehensive strategies to reduce demand along with conservation may need to be considered.***

## Legal Issue

A current lawsuit filed by the Agua Caliente Band of Cahuilla Indians (hereinafter "Tribe") DWA and Coachella Valley Water District (CVWD) is claiming that its federal reserved rights under the Winters Doctrine[36] extended to the region's groundwater resources. The district court held that the Tribe's federal reserved rights did extend to the region's groundwater resources in an amount sufficient to "satisfy the present and future needs of the Tribe and its members" and it was to be protected from overdraft and degradation. That decision was appealed, and on February 23, 2016, a California federal judge granted partial summary judgment to the federal government and the Agua Caliente Band of Cahuilla Indians. If the Ninth Circuit affirms the results of the Phase I trial, Phase II will address whether the tribe owns pore space beneath the reservation, whether there is a right to water of a certain quality, and how to quantify the tribe's federal reserved water right. If necessary, Phase III will quantify the tribe's federal reserved rights to underground water and pore space and order injunctive relief. These rulings could have a significant impact on water availability for both DWA and CVWD, and set a precedent for California.

# SPECIAL ACT DISTRICTS

# Orange County Water District



# Orange County Water District

## Overview

| | |
|---|---|
| **County** | Orange |
| **Area** | Basin: 349 sq mi;[37] OCWD service area: 381 sq mi[38] |
| **Population** | OCWD: 2.4 million[39] |
| **CASGEM** | Medium |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Orange County Water District (OCWD) covers the northern and central portions of the Coastal Plain of the Orange County Groundwater Basin (Basin 8-1 in Department of Water Resources Bulletin 118). The basin is bordered by the Coyote and Chino Hills in the north, the Santa Ana Mountains in the northeast, and the Pacific Ocean in the southwest. The basin is divided into the Forebay Area, where most groundwater recharge occurs, and the Pressure Area, in the central and coastal portions of the basin, where percolation is prevented by clay and silt. It contains three aquifers, Shallow, Principal, and Deep, which are interconnected with one another.[40] The Shallow Aquifer system overlies the entire basin, and it generally occurs from the surface to approximately 250 feet below ground surface. The Principal and Deep Aquifers extend up to 2,000 feet below ground surface in the central part of the basin. These aquifers are unconfined in the Forebay but under "confined" conditions (under hydrostatic pressure) in the Pressure Area. Most of the central and coastal portions of the basin fall within the Pressure Area. Water levels in the Pressure Area exhibit large seasonal variations.

The majority of groundwater from the Shallow Aquifer is pumped by small water systems for industrial and agricultural use, although the cities of Garden Grove and Newport Beach, and the Yorba Linda Water District, operate wells that pump from the shallow aquifer for municipal use. Over 90 percent of groundwater production occurs from wells that are screened within the Principal Aquifer system at depths between 200 and 1,300 feet. A minor amount of groundwater is pumped from the Deep Aquifer, which underlies the Principal Aquifer system. The total storage capacity of all three aquifers is estimated at 66 million acre-feet (AF), although only a fraction of this can be used without causing physical damage such as seawater intrusion or potential land subsidence.[41]

Along the coast, there are four "gaps" formed by ancient meandering of the Santa Ana River, where the Shallow Aquifer is susceptible to seawater intrusion.[42] Groundwater recharge occurs primarily via recharge using Santa Ana base and storm flows, recycled water, and imported water, as well as through percolation of precipitation, urban and irrigation runoff, and seawater inflow.[43] Groundwater flow is unrestricted from the Orange County Basin into the Central Basin to the northeast, and this accounts for a loss of anywhere from 1,000–14,000 acre-feet per year (AFY).[44]

Now a densely populated urban area, until the 1930s land use in Orange County was dominated by agriculture, which accounted for most groundwater use. By 1952, of the total estimated need for

250,000 AFY, 80 percent was for industrial and domestic use, while only 20 percent was for irrigation purposes—exactly the opposite of the pattern in the 1920s.[45]

## Background to Special District Formation

Agriculture began to expand rapidly in Orange County in the early 1900s, leading to increased groundwater extraction. As early as 1905, a federal study uncovered evidence of groundwater depletion, and some farmers organized efforts to protect upstream forest and spread water to encourage recharge.[46] However, the 1920s saw increases in agriculture and the county's population, and groundwater extraction reached 200,000 AFY in 1930. During this time, upstream users were increasing withdrawals from the Santa Ana River, which decreased basin recharge. A 1925 report on the condition of the basin uncovered the first evidence of saltwater intrusion along the coast. In 1932, the Irvine Company, a large agricultural landowner, filed a lawsuit against upstream water users, seeking an injunction to prevent excessive use of Santa Ana River flows. Many defendants in Orange County joined the lawsuit, and support grew for the creation of an entity that could represent the interests of those dependent upon the groundwater basin and provide a way for all to share in the costs of the litigation. In 1933, in response to proposals developed by farmers and political leaders involved in the Orange County Farm Bureau, the state legislature created the OCWD through the Orange County Water District Act.[47]

## Dates

**Creation of the Special District:** 1933
**Revisions or Amendments:**
1953 – to authorize a replenishment assessment and require semi-annual reporting of extractions
1967 – to allow the establishment of a basin equity assessment to incentivize producers not to over-pump
**Other Significant Dates:**
1969 – Santa Ana River Stipulated Judgment (*Orange County Water District v. City of Chino, et al.,* Case No. 117628-County of Orange) establishing Orange County's rights to base and storm flows.

## Special District Summary

OCWD was established to manage the Orange County Groundwater Basin, conserve groundwater supply and quality, reclaim water for beneficial use, and protect surface water rights for Orange County.[48] OCWD's original service area encompassed 254 square miles, which at the time (1933) included a population of 120,000.[49] Its service area has expanded to its current area of 381 square miles through the addition of the cities of Anaheim, Fullerton, and Santa Ana, as well as the purchase of land for recharge purposes. The agency's service area does not completely match boundaries of the groundwater basin, with small portions of the basin falling outside of the service area. Population for the area covered by OCWD is 2.4 million.[50]

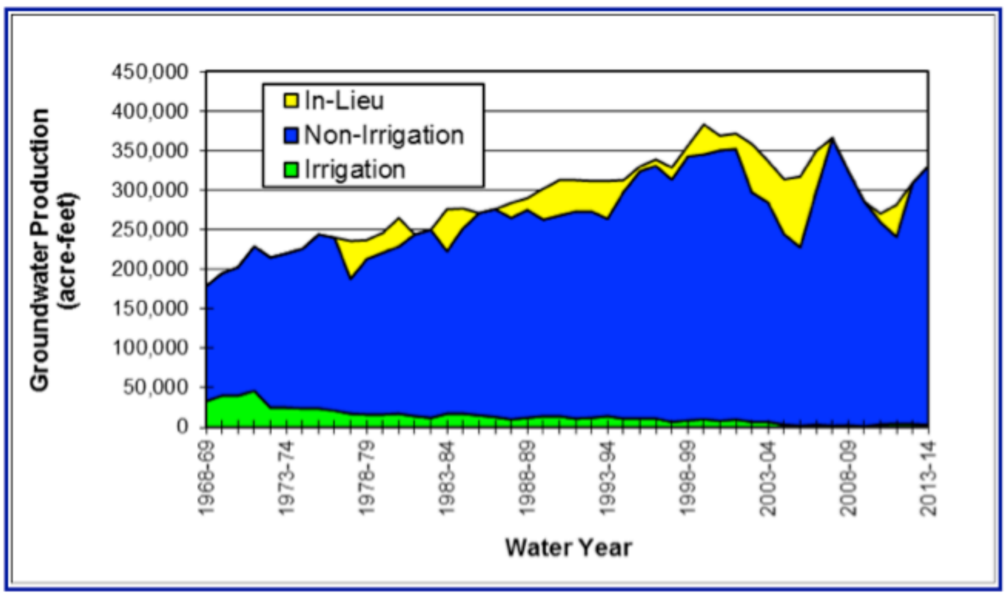
OCWD's original powers included the ability to import water; sell, store, and conserve water; regulate transfers; manage groundwater storage; and represent the interests of Orange County water users. In 1953, its enabling legislation was amended to allow it to charge a fee to recover the costs to purchase imported water, called a replenishment assessment (RA). The district is prohibited from engaging in any action to adjudicate the individual rights of users within its boundaries.[51] OCWD's approach to managing the groundwater basin has focused on providing adequate supply to meet the needs of development and to manage droughts, by recharging the basin through imported water, recycled water, and Santa Ana River flows.

Users are able to pump as much as they like from the groundwater basin; however, OCWD uses a number of tools to discourage over-pumping, including the Basin Production Percentage (BPP). The BPP, first established in 1968, is the percent of total water used by each supplier that is met through groundwater extraction. All water produced at or below the BPP is charged the RA, and any water produced in excess of this percentage is charged the Basin Equity Assessment (BEA). The BEA is an additional incremental charge added to the RA that makes the cost of groundwater equivalent to the cost of purchasing treated imported water. The BPP is set each year to reflect current conditions in the basin. Since the early 1990s, the BPP has fluctuated between 60–70 percent, and producers have sometimes exceeded it and incurred the BEA, but by no more than 10 percent. The basin is managed to maintain water storage levels of not more than 500,000 acre-feet below full condition to avoid permanent and significant negative or adverse impacts.[52]

## Water Users

When OCWD was formed, the majority of water use was for irrigation. Today, most pumping is for municipal use, as shown in Figure 7.

**Figure 7: Historical Groundwater Production Within OCWD[53]**




The 19 members of OCWD produce the majority of water from the basin. They include 13 cities, 5 special districts, and 1 private water company.[54] These producers operate approximately 200 large-capacity wells, which account for about 97 percent of all groundwater production.[55] There are also a number of other small producers, whose numbers have decreased over time. In 1970, there were 780 producers pumping less than 25 AFY, and by 1985 the number had decreased to 250. There are also a small number of non-member producers who pump more than 25 AFY, which include cemeteries, golf courses and country clubs, a few small farms, and various private companies. Overall, non-member producers account for a relatively small amount of overall withdrawals. In 2013–2014, they accounted for 8,705 AF of pumping out of a total of 330,782.[56]

## Management Structure

*Management structure outlined in the legislation and amendments*
The 1933 Act specified a seven-member Board of Directors to govern the agency, with each member representing a division within OCWD. Voting was weighted by property value, with a landowner's vote equivalent to one vote for each $100 of assessed property value. Since funding for OCWD came from an ad-valorem property tax, it gave property owners a voice proportional to their financial contributions to the OCWD. However, by the 1950s, as urban development began to overtake agriculture as the primary land use higher property values no longer reflected agricultural interests. This led to changes in OCWD governance. In 1953, membership on the Board of Directors was expanded to include the cities of Anaheim, Fullerton, and Santa Ana, who were groundwater users but had been previously excluded because their voters were already paying to import water from the Metropolitan Water District (MWD). These cities appointed their Board members rather than electing them. In 1967, an amendment to the Act changed voting in the seven original divisions so each registered voter had one vote.[57]

*Current management structure*
A Board of Directors composed of ten members, each of whom represents a division within OCWD, currently governs OCWD. Seven divisions elect their Board members, and the three remaining members are appointed by the cities of Anaheim, Fullerton, and Santa Ana. Board members serve a four-year term and can be re-elected without limit. The three appointed members may be removed at any time by a majority vote of the governing body appointing them. The Board meets twice a month, and Board committees, which include Water Issues, Communication/Legislation, Administration/Finance, Property/Management, and Retirement, meet once a month. Producer meetings also take place once every month, in which representatives of each of the 19 producers meet with OCWD staff to discuss management issues.[58] The agency has approximately 215 employees.[59] Its annual budget in 2014–2015 was $134 million, supported by revenue from assessments on groundwater producers, property taxes, loans, and grants.[60]

## Management Strategies

OCWD has attempted to manage the basin by providing water as needed for development without mandating reduced water use. OCWD has maximized available water supplies by expanding its capacity for groundwater recharge from four sources: Santa Ana River base flows, Santa Ana storm flows, imported water, and recycled water. Between 2009–2014, total average recharge of the basin amounted to 300,000 AF, of which 30 percent was from Santa Ana River base flows, 14 percent from storm flows, 13 percent from imported water, 23 percent from recycled water, 3 percent in lieu recharge (a program encouraging use of MWD imported water instead of groundwater), and 17 percent incidental recharge (unmeasured recharge from rainfall percolation and other sources).[61] Both incidental and stormwater are affected by precipitation. Table 10 shows a comparison of these sources in 1999–2000 and 2013–2014.

**Table 10: Groundwater Production and Recharge Sources (AF)[62]**

| Water Year | Santa Ana River Base Flow | Santa Ana River Storm Flow | Recycled Water | Imported Water | Incidental Recharge | Groundwater production |
|---|---|---|---|---|---|---|
| 1999–00 | 150,000 | 39,000 | 6,000 | 78,000 | 82,000 | 341,000 |
| 2013–14 | 65,000 | 25,000 | 66,000 | 53,000 | 31,000 | 339,000 |

*Santa Ana River base and storm flows*

Santa Ana River water accounts for the majority of groundwater recharge. In 1969, the legal settlement[63] between OCWD and upstream water users provided OCWD with greater certainty regarding the amount of base flow available. The Santa Ana River Judgment generally allocated the natural supply of water between the upper and lower basins and left individual rights within the basin for users of the water basins to determine internally. OCWD was given the rights to conserve and store storm water behind Prado Dam in Riverside County, and all parties agreed that water which passed through their treatment facilities and into the river must meet the water quality standards of the Santa Ana Regional Water Quality Control Board. The settlement stated that pumpers on the upper basin had to ensure that an average of 42,000 AF of base flow annually reached Prado Dam, which was constructed in 1941 by the Army Corps of Engineers. However, Santa Ana River flows have exceeded the 42,000 AFY base flow by an order of magnitude, with 158,000 AFY reaching Prado Dam in 1999. In 2009, OCWD received a permit from the State Water Resources Control Board to divert up to 362,000 AFY for groundwater recharge each year. In addition to this diversion, OCWD has the right to divert storm water flows, although it is usually only able, on average, to capture about half of storm flows due to the operational constraints of Prado Dam. Most of the storm water lost to the ocean occurs during brief periods of time when storm flows are very high. OCWD works with the Army Corps to manage releases from the dam to maximize the storage of storm flows.[64] Today, OCWD owns and operates 25 facilities that yield an average of 230,000 AFY of surface water recharge.[65]

*Imported water*

OCWD began importing water in 1948 when the Colorado River Aqueduct (CRA) was completed. Imported water is purchased from the Municipal Water District of Orange County (MWDOC), a member of MWD. To finance these purchases, in 1954 OCWD gained the authority to assess an RA fee on groundwater pumping.[66] During the next decade, OCWD bought as much imported water as possible to use for recharge, purchasing over 185,000 AF in 1964. OCWD began to receive deliveries from the State Water Project (SWP) in 1973. However, by the mid-1960s it became clear that imported water was not always reliable, and that recharging the inland portion of the basin would not prevent seawater intrusion. OCWD's policies changed to emphasize reducing reliance on imported water, expanding capacity for recharge through rainfall and river flows, blocking seawater intrusion, and creating incentives to discourage over-reliance on groundwater through the BEA.[67]

*Replenishment*

In the 1950s, concerns over saltwater intrusion increased and a committee of agribusiness and business leaders formed to determine how to raise revenue to replenish the basin. Their proposal was that every producer would have an equal right to pump as much water as he could beneficially use, but that each would also have the obligation to pay the costs of replacing his yearly extractions to continue making the basin as productive as possible. Beginning in 1954, each pumper, or producer, was required to register the city's well(s) with OCWD, maintain records of the amount withdrawn during the year, report that figure, and pay an assessment (the RA) in proportion to the amount of water used. The assessment reflected the estimated amount that could be extracted safely, and how much water would have to be imported to maintain the groundwater at a safe level. After the first RA was collected in 1954, OCWD began to purchase MWD water in large quantities for replenishment.

*Seawater barriers*

To address seawater intrusion, OCWD began a joint program with the Los Angeles County Flood Control District to maintain a fresh water barrier at Alamitos in 1965. OWCD placed 26 injection wells at the mouth of the San Gabriel River to force fresh water into the basin. Water was secured jointly through Los Angeles County Flood Control District and OCWD from MWD. Talbert Gap utilized a more complex arrangement of barrier wells to prevent seawater intrusion.[68]

*Recycled water*

Concerns over the cost of imported water for replenishment and to maintain the freshwater barriers resulted in OCWD's efforts to recycle water. This began in 1975 with the construction of Water Factory 21, the first water treatment plant to use reverse osmosis to treat to drinking water standards.[69] It was replaced in 2008 by the Groundwater Replenishment System (GWRS), which has the capacity to recycle 102,000 AFY, and is used for recharge in the surface water system as well as the Talbert Seawater Barrier. The second source is the Leo J. Vander Lans Water Treatment Facility that is used in the Alamitos Seawater Barrier, with a current capacity of 9,000 AFY (a portion of which is used for recharge of the Central Basin in Los Angeles County).[70]

## Monitoring and Reporting

In 1967, the District Act was amended to require all groundwater users whose production exceeds 1 AFY to report extractions every six months, and pay an RA proportional to their pumping. Those pumping less than 1 AFY are not required to report production levels, and pay a flat annual fee.[71] Approximately 200 large-capacity wells, accounting for 97 percent of all groundwater production, must be metered. Since 1998, monthly extraction data have been required. There are also about 200 small-capacity wells (producing less than 25 AFY), which are not subject to this requirement and report extractions every six months.[72]

To monitor groundwater elevation, storage, and quality, OCWD collects samples from about 200 private and public drinking water wells, and also uses data from samples obtained by other agencies. Water elevation measurements are taken from monitoring wells at various intervals, ranging from every other week to once a year. OCWD conducts extensive water quality monitoring, analyzing water samples for more than 100 regulated and unregulated chemicals. OCWD maintains its own state-certified water quality laboratory, which analyzed more than 17,000 water samples in 2014. Specific monitoring takes place to ensure the effectiveness of the Alamitos and Talbert seawater intrusion barriers. Finally, OCWD monitors Santa Ana River water quality, due to its dependence on this water for groundwater recharge.[73]

## Safe Yield

The natural yield, or safe yield, of the basin is estimated to be 100,000 AFY based on the average natural or incidental recharge of 60,000 AFY and 40,000 AFY of recharge from the Santa Ana River and its tributaries. Due to investments in recharge facilities, the yield of the basin is on the order of 300,000 AFY. In addition, OCWD manages the basin within a "safe operating range" of zero to 500,000 AF below the "full" basin condition of 66 million AF. The safe operating range is defined as the upper and lower levels of groundwater storage in the basin that can be reached without causing negative or adverse impacts, particularly seawater intrusion, and to prevent land subsidence. In order to manage the basin within this safe operating range, OCWD calculates the amount of groundwater in storage on an annual basis. The estimated historical minimum storage level of 500,000 to 700,000 AF below full condition occurred in 1956–1957. Since this time, the basin storage fluctuated within the safe operating range, reaching a full condition in 1969 and 1983.

## Groundwater Pumping and Overdraft

Since OCWD's creation, groundwater production increased significantly. In 1930, groundwater extractions were 200,000 AFY.[74] While they declined to 150,000 AFY by the mid-1950s, extractions began to grow over the following decades, reaching a peak of 360,000 AF in 2007–2008.[75]
Figures for the 2013–2014 water year are in Table 11. There were 4.52 inches of precipitation, which was 34 percent of the long-term average rainfall of 13.4 inches. The total groundwater extraction equaled 330,782 AF (includes in-lieu available water), which represents approximately 70 percent of all water demand within OCWD.[76] Water demand equaled 448,922 AF (excluding water used for replenishment and barrier maintenance), and water for replenishment and barrier maintenance equaled 53,076 AF.[77] However, recharge capacity has also been greatly expanded during this time. In 1936, measured recharge amounted to 50,000 AF, but this increased to a high of 270,000 AF in 1992. When incidental recharge is included, the average recharge between 2009–2014 was 298,000 AF.

In the District Act, "annual overdraft" is defined as the amount by which groundwater extraction exceeds natural replenishment. According to this measure, the average annual overdraft during 2009–2014 was 110,000 AFY; in 2013–2014, a dry year, annual overdraft was 211,000 AF. Given the extent of artificial recharge, this figure is not considered an indicator of the condition of the basin.

**Table 11: 2013–2014 Water Year Accounting[78]**

| Extractions | Total Demand (includes replenishment and barrier maintenance) | Production (includes available in-lieu water | Annual Overdraft | Cumulated Overdraft | Precipitation 7/1/13–6/30/14 |
|---|---|---|---|---|---|
| 330,782 AF | 501,998 AF | 330,782 AF | 211,000 AF | 342,000 AF | 4.52 in. (long-term average = 13.4 in.) |

The basin's storage level is quantified based on a benchmark defined as the full basin condition. Although the groundwater basin rarely reaches the full basin condition, basin storage has fluctuated within a defined safe operating range for many decades. Thus OCWD specifies that "overdraft" in the traditional sense does not exist in the OCGB because the basin is operated to continuously fluctuate within the safe operating range. The process that determines a sustainable level of pumping considers this basin's safe operating range, as well as basin storage conditions, water demands, and the amount of recharge water available to the District. The basin is managed to avoid groundwater elevations dropping to levels that result in negative or adverse impacts,, including chronic groundwater levels indicating a significant and unreasonable depletion of supply if continued over the long-term, increased seawater intrusion, significant and unreasonable land subsidence that substantially interferes with surface land uses, and increased pumping costs.[79]

The degree to which the storage is below the full basin condition is defined as the "accumulated overdraft." The OCWD calculates and reports accumulated overdraft in its annual Engineers Report, as illustrated in Figure 8. In June 2014, accumulated overdraft was 342,000 AF, which represents the amount of water needed to return the basin to the "full" condition. Since 1975, accumulated basin overdraft has ranged from 0 in 1983 to approximately 450,000 AF in 1977, one of the most severe drought years. The most recent projection is that accumulated overdraft will reach 415,000 AF in 2015, assuming average conditions. OCWD has also detailed the benefits and constraints of different levels of accumulated overdraft, as shown in Table 12 for Water Years 1974–1975 to 2013–2014.[80]

**Figure 8: Accumulated Basin Overdraft: Change in Groundwater Storage**

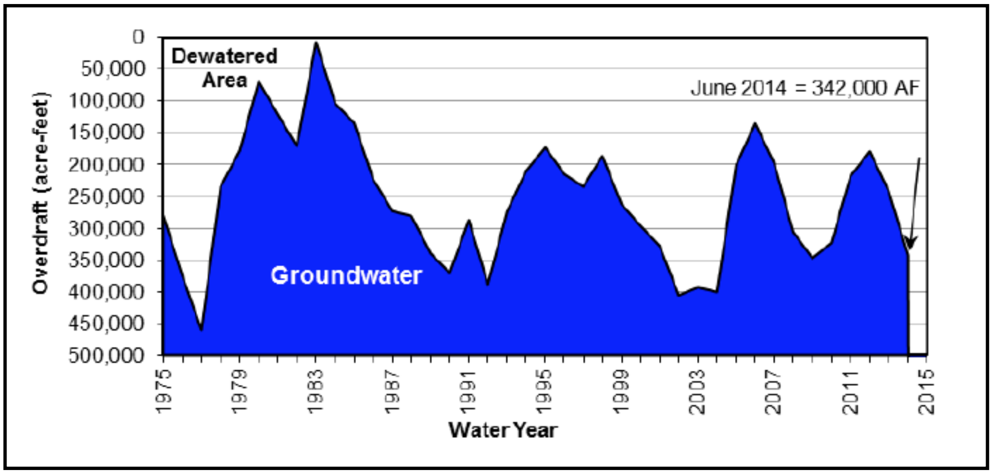



**Table 12: Benefits and Constraints of Differing Available Storage Space**

| Available Storage Space (amount below full basin condition in acre-feet) | Benefits | Constraints |
|---|---|---|
| Less than 200,000 | • Improve control of seawater intrusion<br>• Lower cost to pump groundwater<br>• Maintain stable BPP; potential to increase BPP<br>• Increase supply of water for pumping in dry years<br>• Decrease potential for vertical migration of poor quality water | • Increase groundwater flow to Los Angeles County<br>• Possible impacts of high groundwater levels in local areas<br>• Decrease opportunity to recharge basin when low-cost recharge water available |
| 200,000 - 350,000 | • Minimal to no impacts from high groundwater levels<br>• Increase available storage capacity when recharge water available<br>• Decrease groundwater outflow to Los Angeles County | • Reduced amount of water in storage for pumping during drought<br>• Increase risk of seawater intrusion |
| 350,000 to 500,000 | • Minimal to no problems with high groundwater levels<br>• Increased available storage capacity if large amount of recharge water becomes available<br>• Further decrease in groundwater outflow to Los Angeles County | • Reduce supply of water in storage available for dry years<br>• Increase pumping costs<br>• Increase risk of seawater intrusion<br>• Some production wells inoperable when groundwater levels below 400,000 acre-feet<br>• Potential risk of increased land subsidence<br>• Potential increased risk of vertical migration of poor quality water<br>• Need to increase purchase of imported water<br>• Difficult to maintain stable BPP |

With respect to land subsidence, available sources of data demonstrate that depending on the time period selected, the ground surface is rising, falling, or remaining stable in tandem with groundwater levels and overall changes in basin groundwater storage. This is referred to as *elastic subsidence.* OCWD's groundwater management plan indicates that during extreme drought conditions, operating outside of the safe range would be possible for short periods.[81] This falls within the safe operating range of up to 500,000 AF below "full" condition.[82]

## Water Quality

Salinity is a significant water quality problem in the basin, stemming from the high salinity levels of water used for recharge (particularly Santa Ana base flows and imported water from the Colorado River), as well as seawater intrusion and leakage from septic tanks. Salinity in the Santa Ana River watershed is managed through the operation of several desalters, which send water to the Orange County Sanitation District through the Empire Brine Line, a project of the Santa Ana Watershed Project Authority of which OCWD is a member agency. In addition, OCWD has been replacing some imported water with recycled water from the GWRS which has very low salinity.[83]

Seawater intrusion, which occurs through permeable sediments in four "gap" areas along the coast, has been a problem since the 1920s. Two seawater barriers, Alamitos and Talbert, were constructed in 1965 and 1975 respectively, and have enabled the basin to sustain extractions of up to 500,000 below full condition without causing seawater intrusion. These barriers consist of a series of wells into which mostly recycled water is injected. OCWD conducts extensive monitoring to ensure that salinity does not increase.[84]

## Disputes

OCWD has been involved in a number of lawsuits throughout its history, mostly focused on curtailing use by upstream users in the Santa Ana Watershed. As a result of these lawsuits, OCWD and four other agencies formed the Santa Ana Project Watershed Authority (SAWPA), a Joint Powers Authority that undertakes projects to resolve water quality problems and maintain watershed health. SAWPA has provided an important forum for upstream and downstream users to work together to resolve disputes and undertake joint actions to maintain the watershed and groundwater basin.[85] Among users within OCWD's service area, monthly producer meetings provide an opportunity for members to discuss concerns with OCWD staff.

## Discussion

OCWD has remained within the safe operating range for many decades. The basin reached its lowest storage level of an estimated 500,000–700,000 AF below full condition in 1956–1957. Since this time, the basin has remained above the 500,000 AF level, and reached full condition in 1969 and 1983.[86] Groundwater levels have fluctuated significantly during this period, and patterns differ between the Forebay Area (where most recharge occurs), and the Pressure Area (closer to the coast). Levels in the Forebay Area have increased significantly since 1932, reaching a full condition in 1965 following OCWD's intensive recharge efforts using imported water. In contrast, water levels in the Pressure Area have declined from about 20 ft above sea level in 1970 to about 20 ft below sea level in 2014, according to monitoring well records.[87] However, due to the Talbert and Alamitos seawater barriers, water levels below sea level no longer indicate that seawater intrusion is occurring.

Since 1975, accumulated basin overdraft has ranged from 0 in 1983 to approximately 450,000 AF in 1977, one of the most severe drought years. The most recent engineer's report projects that accumulated overdraft will reach 415,000 AF in 2015, assuming an average hydrology. This falls within OCWD's definition of the safe operating range of up to 500,000 AF below "full" condition.[88]

## Analysis

1. Under OCWD's approach, groundwater users do not have established individual rights to pump specific amounts of groundwater. Rather than restrict pumping, OCWD has relied on obtaining additional supplies to manage the basin with the goal of maximizing the use of groundwater without causing seawater intrusion or other adverse effects, and they use incentives to reduce pumping.

2. Instead of managing the basin to meet a "safe yield," OCWD operates the basin within the "safe operating range" of zero to 500,000 AF below "full" basin condition, allowing for some accumulated overdraft. To operate in this range, OCWD has sought to maximize recharge of the basin, investing in the expansion of groundwater recharge facilities, and relying upon a combination of Santa Ana River flows, imported water, and recycled water. In addition, OCWD has built two seawater barriers in the coastal area to prevent seawater intrusion. Through these efforts, OCWD has maintained the basin within the safe operating range since 1957, while allowing for significant increases in annual groundwater extractions by its 19 member agencies.

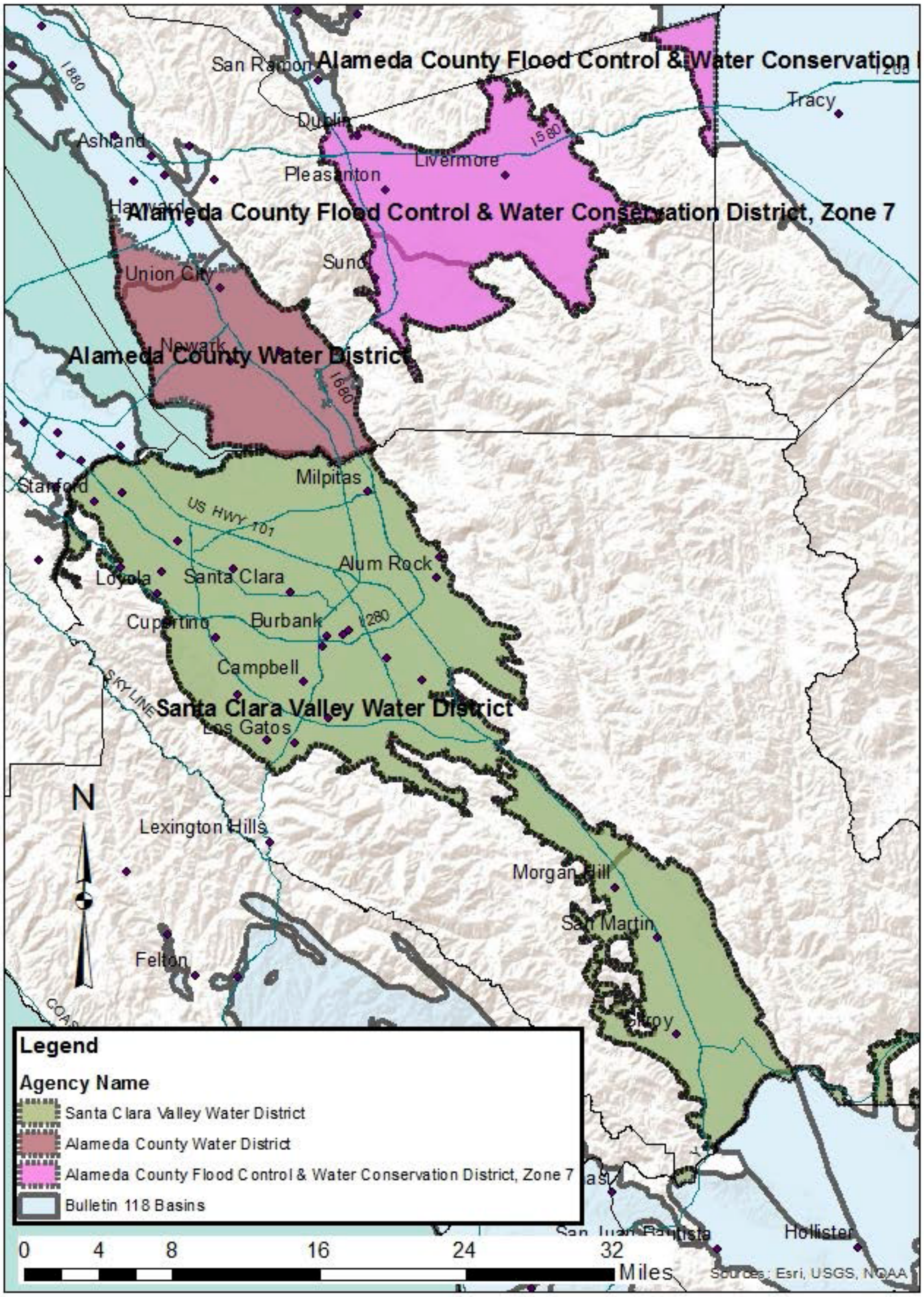
3. OCWD has several tools to manage pumping and maintaining storage within the established safe range, including the BPP, RA, and BEA. Having access to imported water allows this management structure to work. Knowing that future supplies of imported water are becoming less secure, OCWD is taking steps to maximize locally available supplies, such as recycled water.

4. Along with the continuing development of local supplies, augmenting additional demand reduction approaches may be necessary in the future to address the increased demand that occurs during extended dry periods, as well as to provide for sufficient replenishment during wet periods to assure that the basin remains within the safe operating range.

| Funding Mechanisms | Other Capabilities |
|---|---|
| **Funds are derived primarily through:**<br>**1. Annual assessments** on its 19 water retailers, who pump groundwater from the basin.<br>**2. Ad valorem property taxes.**<br><br>**Additional funding sources include:**<br>**3. Negotiable promissory notes –** used primarily to fund new large-scale, infrastructure projects<br>**4. Municipal bonds**<br>**5. Interest on investments:** OCWD maintains a large investment portfolio as an additional source of financial reserves. | **Regulate pumping:** Yes (with many specific restrictions and provisions, as per the District Act)<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body:** Seven of the ten Directors are elected directly by registered voters, each representing a specific geographic subdivision of OCWD. The remaining three Directors are appointed by the cities of Anaheim, Fullerton, and Santa Ana.<br>For full text of Orange County Water District Act, please see: http://www.slocountywater.org/site/Water%20Resources/Advisory%20Committee/Agendas/2008/WRAC-Agenda-0908-Docs-Submitted/S.Harvey%20Submittal.pdf |

| Special District | Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
|---|---|---|---|---|---|
| Orange County Water District | OCWD has not established any figures for safe yield, instead managing basin storage with a "safe operating range" up to 500,000 AFY of accumulated overdraft. | For 2013–2014 water year:<br>Total groundwater extraction = 330,782 AF (includes in-lieu available water).<br>Total water demand including water for replenishment and barrier maintenance = 502,998 AF. | Groundwater levels have generally declined since the 1960s. Levels in the Forebay Area have increased since the mid-20th century, but levels elsewhere dropped, with water levels in the Pressure Area (further inland) declining from more than 20 feet above sea level in the 1970s to more than 20 feet below sea level today. | For the 2013–2014 water year: The "annual overdraft" (annual basin storage decrease without supplemental replenishment water) was 211,000 AF, and the annual basin storage, including the use of supplemental replenishment water, decreased by 100,000 AF.<br><br>Accumulated basin overdraft increased from 242,000 AF on 6/30/2013 to 342,000 AF on 6/30/2014 after the second year of drought.<br><br>Average annual overdraft during 2009–2014 was ~110,000 AFY.<br><br>Gains were seen in some wet years, but in most recent years extractions outstripped recharge. | Saline intrusion is the most serious long-term challenge. A series of expensive desalters, and two seawater barriers along geologically permeable stretches of the coast help insulate the aquifer. |

# Bay Area Special Act Districts



# Santa Clara Valley Water District

## Overview

| | |
|---|---|
| **County** | Santa Clara[89] |
| **Area** | 1,304 sq mi[90]<br>Surface Area of Santa Clara Groundwater Sub-basin: 297 sq mi[91]<br>Surface Area of Llagas Groundwater Sub-basin: 87 sq mi[92] |
| **Population** | >1.8 million [93] |
| **CASGEM Priority** | Santa Clara Sub-basin – Medium[94]<br>Llagas Sub-basin – High[95] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Santa Clara Valley Water District (SCVWD) is the exclusive groundwater management agency for Santa Clara County, which overlies the Santa Clara and the Llagas Sub-basins.[96]

The Santa Clara Groundwater Sub-basin is the more extensive of the two basins under SCVWD purview, and it occupies a structural trough parallel to the northwest-trending coastal ranges. It extends from the northern border of Santa Clara County southward to the groundwater divide near the town of Morgan Hill, and is bounded on the west and east by the Santa Cruz Mountains and the Diablo Range, respectively. The dominant hydrogeologic feature is a large inland valley, which is drained to the north by tributaries to the San Francisco Bay, including the Guadalupe River, Coyote Creek, and Los Gatos Creek. Groundwater is found in Pliocene- to Holocene-age continental deposits of unconsolidated to semi-consolidated gravel, sand, silt, and clay. Lithologic similarities make distinctions difficult between the older, deeper Plio-Pleistocene Santa Clara Formation and the younger overlying alluvium of Pleistocene to Holocene age. Taken together, the combined depth of these two layers exceeds 1,500 feet. Nearly all large production wells within the sub-basin extract their water from the upper Pleistocene-Holocene alluvium, which is comprised of mostly unconsolidated gravel, sand, silt and clay, and deposited as a series of convergent alluvium fans. A confined layer exists under some parts of the northern sub-basin, but the southern part of the sub-basin is generally unconfined, containing no overlays of clay.[97] For administrative purposes, the Coyote Valley, which underlies the far southern portion of the Santa Clara Sub-basin, is delineated from the rest of the Sub-basin by SCVWD, but this is due to the Coyote Valley's largely rural character rather than any hydrologic distinctiveness.

The smaller Llagas Sub-basin occupies a northwest trending structural depression beneath the far southern portion of Santa Clara County, and shares many hydrogeologic similarities with the larger, hydrogeologically distinct Santa Clara Sub-basin. The Llagas Sub-basin lies south of the groundwater divide near the town of Morgan Hill, which separates it from the larger Santa Clara Sub-basin to the north. Like the Santa Clara Sub-basin, it is bounded on the east by the Diablo Range and on the west by the Santa Cruz Mountains, while its southern boundary extends to the Pajaro River. Water-bearing formations include Pliocene- to Holocene-age continental deposits of unconsolidated to semi-consolidated gravel, sand, silt, and clay. These include the deeper Plio-Pleistocene-age Santa Clara Formation, which reaches a depth of 1,800 feet, and overlying Holocene-age alluvial fans. Alluvial fan deposits range from 3 to 125 feet deep within the Llagas Sub-basin and overlie both the Santa Clara Formation and other non-water-bearing deposits. Similar to the Santa Clara Sub-basin, lithologic similarities make it difficult to accurately distinguish the boundaries between these two layers.[98]

## Background to Special District Formation

Local communities in the Santa Clara Valley relied on groundwater since the first wave of Anglo settlement in the 1850s.[99] By the turn of the twentieth century, more than 14,000 acres of orchards and vineyards in the Valley relied on groundwater irrigation, and, starting in the first decade of the twentieth century, local farmers began to notice a significant drop in water levels in their wells. By 1920, concerns over accelerating land subsidence sparked a coalition of farmers and business owners to push for the formation of the Santa Clara Valley Water Conservation Committee. Over the following decade a plan was developed to construct a series of large reservoirs to capture rainfall and begin replenishing the underground aquifer through artificial recharge. This plan culminated in the formation of the Santa Clara Valley Water Conservation District in 1929 to oversee the construction of SCVWD's first six reservoirs.[100]

## Dates

**Creation of the Special District:** 1929[101]
**Revisions or Amendments:**
1952 – The Santa Clara County Flood Control and Water Conservation District is established, annexing the previously independent Central Santa Clara Water Conservation District. This new District initially existed as a separate entity from the older Santa Clara Valley Water Conservation District.
1968 – The Santa Clara County Flood Control and Water District merges with the older Santa Clara Valley Water Conservation District to form a single agency, SCVWD, to manage water supply in northern Santa Clara County and provide flood protection within Santa Clara County.
1987 – The Gavilan Water District merges with SCVWD, providing for a single, countywide water management agency.
2007 – AB 2435 passes the state legislature, ending county oversight of SCVWD's budget and other procedural holdovers from the 1968 merger.
**Other Significant Dates:**
1965 – State Water Project (SWP) deliveries to Santa Clara County begin, augmenting local recharge efforts and supporting treated surface water deliveries, which halts nearly five decades of land subsidence in the Santa Clara Valley by the early 1970s.
1987 – Central Valley Project (CVP) deliveries to Santa Clara County through San Luis Reservoir.[102]

## Special District Summary

Under its enabling act, SCVWD has the authority to manage water resources and provide flood protection in Santa Clara County. In exercising its authority to manage water resources, SCVWD acts as both a wholesaler of water and a groundwater management agency for all of Santa Clara County.

In 2015, Santa Clara County's population was 1,908,044.[103] The county includes the City of San Jose, the tenth-most populous city in the United States. Located at the southern end of the San Francisco Bay, the highly urbanized Santa Clara Valley within Santa Clara County is also known as Silicon Valley. Santa Clara is the most populous county in the San Francisco Bay Area region, and one of the most affluent counties in the United States. The median income for a household in the county from

2010–2014 was $93,854.[104] Santa Clara County was once dubbed "Valley of Heart's Delight" and still has pockets of agriculture in this largely urbanized area.[105]

The SCVWD's initial focus was to plan and oversee the construction of reservoirs to capture and store local surface water for the purposes of groundwater recharge to address rapidly declining groundwater levels and land subsidence, which was first observed in the 1910s. The SCVWD's first five reservoirs were completed in 1935, with a sixth completed the following year. Groundwater levels began rising across the Santa Clara Sub-basin during the initial years following the completion of the first six reservoirs, and this recovery continued until 1947, when dry conditions and continued pumping resulted in declining water levels and increased subsidence. In the 1950s, four additional reservoirs were constructed and the San Francisco Public Utilities Commission (SFPUC) began delivering imported water from the Hetch Hetchy system to several water retailers. But groundwater level declines beginning during the post-World War II population boom would continue unabated into the 1960s. Around this time both saltwater intrusion into groundwater near the San Francisco Bay, coupled with accelerating land subsidence across the Santa Clara Valley, made additional investments in groundwater sustainability a top priority for SCVWD.[106]

The first State Water Project (SWP) water became available in 1965, providing SCVWD with an additional water source for managed recharge. In 1967, SCVWD also took advantage of this new source to begin wholesale deliveries of treated surface water. This greatly reduced the need for pumping and helped water levels recover by providing in-lieu recharge. By 1969, SCVWD had essentially halted land subsidence, which exceeded 13 feet in downtown San Jose during the period from 1915 to 1970.[107] SCVWD investments in additional water treatment plants, CVP supplies for direct and in-lieu recharge, water conservation, and water recycling led to generally rising groundwater levels across the Santa Clara Sub-basin beginning in the 1970s, and continuing throughout the rest of the twentieth century. In the Llagas Sub-basin, groundwater levels in many areas reached their lowest level during the 1976–1977 drought, but began rising in the decades that followed as enhanced recharge efforts reached the southern portion of Santa Clara County.[108]

The passage of AB 2435 in 2007 removed the requirement in the District Act that the County Board of Supervisors approve SCVWD's annual budget.[109] The SCVWD had authority to recharge groundwater basins; increase its water supply; conserve, manage, and store water for beneficial and useful purposes; protect surface and groundwater from contamination; prevent waste or diminution of SCVWD's water supply; and ensure that groundwater is available for future beneficial and useful purposes. SCWVD's primary funding sources include revenues generated from the sale of treated water to municipal and investor-owned utility water retailers and groundwater charges that are levied on all municipal and private well operators that extract groundwater within a SCVWD groundwater charge zone.[110]

## Water Users

As the wholesale water provider for Santa Clara County, SCVWD serves four customer classes, including groundwater users, treated water users, surface (untreated) water users and recycled water users. Groundwater users pump water from the ground that is both naturally and artificially recharged into the groundwater basin. The treated water users are seven water retailers, municipalities, or investor-owned utilities that take treated surface water from one of SCVWD's three treatment plants and sell it to the end customer. The water from these plants comes from locally captured or imported surface water. Surface water users are those users permitted by SCVWD to divert raw surface water from creeks, streams, or pipelines.[111] Recycled water users obtain their water from turnouts from one of the county's four recycled water systems.[112]

Water pumped from the two primary groundwater sub-basins underlying Santa Clara County is used by water retailers, private well operators, farmers, and smaller water retailers operating within Santa Clara County.[113] The SCVWD is not, itself, a water retailer, but rather sells water wholesale to retailers who then supply urban and industrial consumers in Santa Clara County. Municipal and industrial (M & I) uses comprise the overwhelming bulk of water consumption in Santa Clara County, especially in the county's more heavily urbanized north, and while there are more wells in South County, North County has a much larger extraction volume.[114]

In 2013, total county groundwater production amounted to 149,800 acre-feet (AF), of which 83.78 percent was used for non-agricultural purposes. In the urbanized Santa Clara Plain, groundwater production totaled 92,100 AF, of which 99.24 percent was non-agricultural; while in the more rural southern portion of the county groundwater production amounted to 57,700 AF, of which 59.10 percent was non-agricultural.[115]

## Management Structure

SCVWD's management structure has undergone a number of changes since its inception. Under AB 2435, the Board of Directors was to consist of five elected Board members, one elected from each of the county's five supervisorial districts, and an additional two board members to be appointed by the Board of Supervisors of Santa Clara County, representing SCVWD at-large.[116] This process was further amended in 2010 by AB 466, which specified that the county's registered voters from equally divided districts drawn through a formal process outlined in this legislation elect all seven board members.[117] Though the seven districts must be as equal in population as reasonably possible, the board may give consideration to topography, geography, cohesiveness, contiguity, integrity, compactness of territory, and community interests when drawing its boundaries.[118]

The seven directors serve overlapping, four-year terms, a structure created pursuant to the adoption of AB 2435.[119] Pursuant to AB 2435, the board governs SCVWD, and directs the CEO and board-appointed officers.[120] The total operating and capital budget for SCVWD was $469.1 million for FY 2014–2015.[121] Recruiting new talent is currently cited as a priority among SCVWD Board members, with an estimated 57 percent of SCVWD employees eligible for retirement within the next three years.[122]

## Management Strategies

The 2001 Groundwater Management Plan (GMP) included the following strategies for SCVWD:

*Water storage*
SCVWD has conjunctively managed groundwater and surface water since the 1930s. SCVWD's initial focus was to plan and oversee the construction of reservoirs to capture and store local surface water for the purposes of groundwater recharge to address rapidly falling groundwater levels and land subsidence, which was first observed in the 1910s. The SCVWD's first five reservoirs were completed in 1935, with a sixth completed the following year.[123] Groundwater levels began rising across the Santa Clara Sub-basin during the initial years following the completion of the first six reservoirs, and this recovery continued until 1947, when dry conditions and continued pumping resulted in declining water levels and increased subsidence.[124] In the 1950s, four additional reservoirs were constructed, and the San Francisco Public Utilities Commission began delivering imported water from the Hetch Hetchy system to several water retailers.

*Imported water*
Groundwater level declines beginning during the post-World War II population boom would continue unabated well into the 1960s. Around this time, saltwater intrusion into groundwater near the San Francisco Bay, coupled with accelerating land subsidence across the Santa Clara Valley, made additional investments in groundwater sustainability a top priority for SCVWD.

The first State Water Project (SWP) water became available in 1965, providing SCVWD with an additional water source for managed recharge. In 1967, SCVWD also took advantage of this new source to begin wholesale deliveries of treated surface water. This greatly reduced the need for pumping and helped water levels recover by providing in-lieu recharge. By 1969, SCVWD had essentially halted land subsidence, which was 13 feet in downtown San Jose during the period from 1915 to 1970, the maximum recorded in Santa Clara County.[125] Lesser amounts were observed over a wide area of over 100 square miles.[126]

SCVWD investments in additional water treatment plants, CVP supplies for direct and in-lieu recharge, water conservation, and water recycling led to generally rising groundwater levels across the Santa Clara Sub-basin beginning in the 1970s, and continuing throughout the rest of the twentieth century.[127] In the Llagas Sub-basin, groundwater levels reached historic lows in some areas, especially Morgan Hill, prior and during the 1976–1977 drought, but began rising in the decades that followed as enhanced recharge efforts reached the southern portion of Santa Clara County.[128]

The SCVWD maintains appropriative water rights for over 225,000 AF of local surface water, which is used for groundwater recharge and to supply water treatment plants. Both local and imported surface water are essential to sustaining groundwater in Santa Clara County, as are continued investments in water conservation and recycling.[129]

*Current strategies*
The 2012 Groundwater Management Plan (GMP), replacing the older 2001 Plan, developed the following two primary basin management objectives (BMOs) for SCVWD:

1. Manage groundwater supply to maximize water supply reliability and minimize land subsidence
2. Protect groundwater from existing and potential contamination, including saltwater intrusion[130]

To achieve these BMOs, SCVWD established four primary strategies, described below:

*Conjunctive management*
Using surface water for direct and in-lieu recharge programs to sustain groundwater supplies and minimize saltwater intrusion and land subsidence.[131] Components include the following:

- Maintaining water supply sources and existing recharge facilities
- Developing additional recharge facilities to further augment groundwater recharge
- Resolving dam safety issues that currently restrict reservoir storage
- Promoting water conservation and water recycling programs[132]

Some of these components, such as using SWP and CVP water for direct and in-lieu groundwater recharge, have been in place for many decades; whereas others, such as increasing water reuse, have been implemented more recently and are currently being expanded to help SCVWD cope with drought and population growth.

*Implementing programs to protect and promote groundwater quality*
Most groundwater in the sub-basins is already of high quality, with few systems requiring wellhead treatment prior to delivery to customers. To ensure this remains the case, this strategy involves the following actions:

- Assessing regional conditions and trends
- Continuing comprehensive water quality monitoring efforts
- Evaluating threats to groundwater quality
- Conducting technical studies and vulnerability assessments[133]

*Developing and maintaining adequate groundwater models and monitoring systems.*[134]
The SCVWD has ongoing programs to monitor groundwater levels, groundwater quality, recycled water quality, recharge water quality, surface water flow, and land subsidence. It works with local water retailers who purchase its water to evaluate current conditions and prevent overdraft and subsidence.[135] This also includes developing long-range water projections to assist with operations and long-range planning. Such models include water supply system models, as well as calibrated flow models for the Santa Clara and Llagas Sub-basins, to evaluate groundwater storage and levels under various operational and hydrologic conditions.[136]

*Working with regulatory and land-use agencies to protect recharge areas and prevent groundwater contamination*
Over the past half-century land use across the Santa Clara Plain has transitioned from largely agricultural to heavily urbanized and densely populated. This transition has increased the proportion of land covered by impervious materials, increasing runoff and reducing natural recharge across the areas with the highest quantities of water use. To increase the rates of recharge and reduce the risk of contamination from urban and industrial runoff, SCVWD coordinates with local and regional land-use agencies to minimize impacts from existing contamination and prevent further contamination from occurring. This process includes developing technical studies, participating in public policy development, and coordinating with other public agencies on proposed development projects.[137]

## Monitoring and Reporting

The SCVWD and water retailers conduct most of the groundwater monitoring and reporting in Santa Clara County.[138] The SCVWD conducts extensive monitoring of groundwater levels, quality, and land subsidence, and makes related information available through publically available reports.[139] Private (agricultural) well operators and rural domestic consumers comprise only a small fraction of total groundwater production in Santa Clara County, though they do make up a relatively larger share of water extraction from the Llagas Sub-basin.[140] Unlike many other Special Districts in California where agricultural needs comprise the overwhelming share of groundwater extraction, such uses typically comprise less than 20 percent of total groundwater production in areas under SCVWD purview.[141]

Permitting requirements and inspections are required for all well construction and destruction, and metering and reporting requirements are in place for all wells located within SCVWD groundwater charge zones. Metering requirements vary between administrative zone W-2 (north County) and administrative zone W-5 (south County). In the more densely populated north, meters are required for all agricultural wells extracting more than 4 acre-feet per year (AFY) and all other wells extracting more than 1 AFY.[142] In the less populated southern portions of the county, meters are required for agricultural wells that extract more than 20 AFY and all other wells that extract in excess of 2 AFY.[143]

Although there are some large industrial users in Zone W-2, overall there are relatively few private wells, and over 90 percent of groundwater pumped is for water retailers. The retailers may also get water from SFPUC (Hetch Hetchy), treated water from SCVWD, groundwater withdrawals, or local surface water.[144]

## Safe Yield

SCVWD does not identify a "safe yield" but works to balance pumping with managed recharge, in-lieu recharge programs, water conservation, and recycling.[145] The natural recharge long-term average is 54,000 AF.[146] Current rates of groundwater consumption amount to nearly three times the rate of naturally occurring groundwater recharge.[147]

## Groundwater Pumping and Overdraft

Groundwater production initially exceeded the rate of recharge. This was offset by the construction of reservoirs, which, under current conditions, are able to store about 123,000 AF of water.[148] Since the 1960s, imported water from the SWP has been used to recharge the aquifers and provide treated water deliveries. Additional imports from the San Francisco Public Utility Commission (SFPUC) provide additional water to M & I users.[149] Since the 1980s, imported water from the CVP has also been an important water source for direct and in-lieu groundwater recharge. Long-term water conservation programs and recycled water offset the need for groundwater pumping, on the order of 64,000 AFY and 21,000 AFY, respectively.[150]

Total water use, which includes SFPUC deliveries, local surface water, and recycled water, is on the order of about 350,000 AFY. Water imports and significant short-term water use reduction have kept groundwater levels stable, and groundwater levels across the Santa Clara Sub-basin are, on average, higher than at any time during the period from 1945–2000.[151] Compared to their lowest recorded levels in the mid-1960s, average groundwater levels across the Santa Clara Basin are, on average, higher than at any time during the period from 1945–2000.[152] Gains in the average groundwater level in the Llagas Sub-basin were far less dramatic, but were, nonetheless, higher in 2013 than at their low point during the drought of 1976–1977.[153] Figure 9 illustrates the long-term trend in groundwater elevations. Table 13 demonstrates the change in storage from 2014 to 2015 during a drought.

Note that while current rates of groundwater consumption are higher than the rate of naturally occurring groundwater recharge,[154] maintaining stable groundwater levels in both basins is entirely dependent on the continued availability of SWP water and other imported sources for groundwater recharge.[155]

**Figure 9: SCVWD Groundwater Levels 1900–2015**[156]

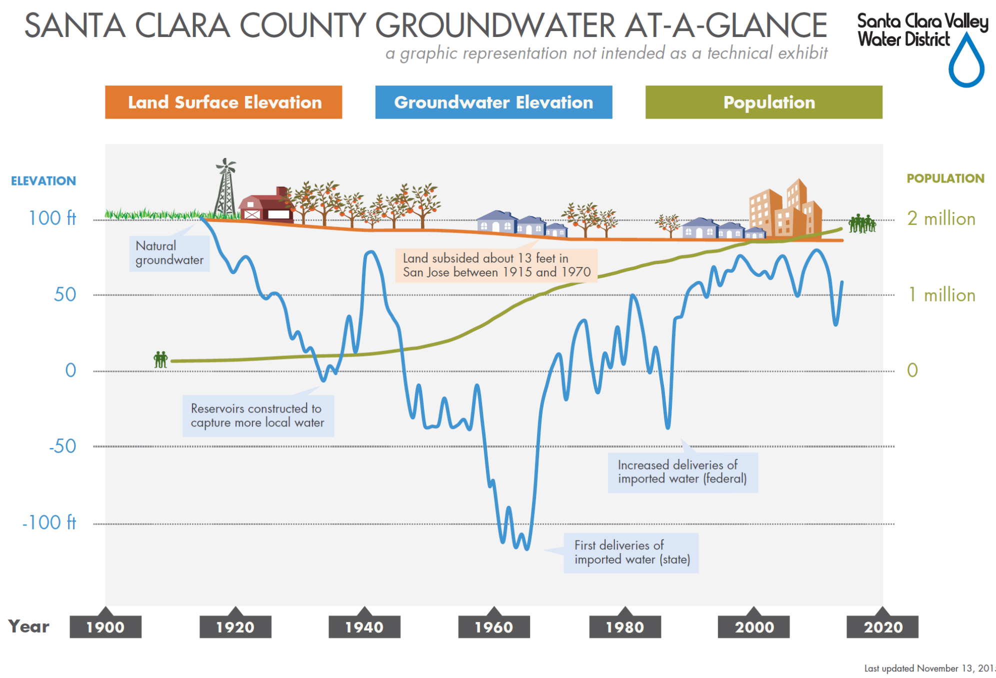



**Table 13: End-of-Year Groundwater Storage and Change in Storage**[157]

| | Cumulative Groundwater Storage Estimates (AF) | | |
|---|---|---|---|
| | **End of Year 2014** | **End of Year 2015** | **Change in Storage (AF)** |
| Santa Clara Sub-basin, Santa Clara Plain | 235,700 | 221,000 | -14,700 |
| Santa Clara Sub-basin, Coyote Valley | 5,400 | 400 | -5,000 |
| Llagas Sub-basin | 15,400 | 13,800 | -1,600 |
| **Total** | **256,500** | **235,200** | **-21,300** |

Note: Groundwater storage estimates are based on accumulated groundwater storage since 1970, 1991, and 1990 for the Santa Clara Plain, Coyote Valley, and Llagas Sub-basin, respectively. These estimates are refined as additional pumping and managed recharge data become available. Table is updated from 2016–2017 Protection and Augmentation of Water Supplies Report.

## Water Quality

Nearly all publicly operated groundwater wells in the sub-basins produce high-quality water with few widespread or significant areas of water quality deterioration.[158] However, a 1998 study found that nearly half of all privately operated wells in agricultural areas of southern Santa Clara County had nitrate levels that exceeded the California Division of Drinking Water (DDW) guidelines. Overall, nitrate poses the most significant water quality threat across the county, and is especially prevalent in the more rural south county. To better understand the occurrence of nitrate in these areas, the District has implemented limited duration programs to provide free nitrate testing to domestic well owners in the Coyote Valley and Llagas Sub-basin. In 2011, SCVWD expanded this program to provide free testing for other water quality parameters such as conductivity, hardness, and bacteria.[159] The SCVWD also offers rebates to eligible well users for certified nitrate treatment systems.[160]

In the 1980s, groundwater contamination from leaking chemical storage tanks at an IBM facility brought water quality concerns to the fore, resulting in more rigorous groundwater testing and pollution control measures in the years that followed. Measures included working closely with regulatory agencies that oversee hazardous waste cleanup, implementing programs to seal abandoned wells, implementing measures to reduce and control nitrate loading, overseeing fuel leak cases, and lobbying the state legislature to introduce more stringent pollution regulations, such as restrictions on methyl tertiary-butyl ether (MTBE), a former gasoline additive.[161]

The SCVWD also coordinates with the agencies that regulate environmental release sites to ensure the investigation and cleanup is conducted to protect the county's groundwater resources. Historically, saltwater intrusion was a significant water quality problem in areas adjacent to the San Francisco Bay and remains a potential threat in the absence of recharge from imported water sources.[162] During the latter part of the twentieth century, an extensive program located and destroyed abandoned wells across the northern part of the county to prevent them from acting as conduits for saltwater intrusion from the San Francisco Bay.[163] Today, the threat of saltwater intrusion is understood to be less significant than the threat of nitrate contamination and contaminant release sites, but problems could increase in the absence of continued groundwater recharge with imported water.[164]

## Disputes

As a public entity and due to its size and its activities, SCVWD is often times a defendant, co-defendant, or cross-defendant in judicial court cases and administrative proceedings. Pending cases and administrative matters of great significance include *Great Oaks Water Company v. Santa Clara Valley Water District* (the "Great Oaks Case"), and *Guadalupe Coyote Resources Conservation District v. Santa Clara Valley Water District* (the "Water Rights Complaint").

*Great Oaks Case*

In 2005, Great Oaks Water Company (Great Oaks) filed an administrative claim alleging that the SCVWD's groundwater charges for Fiscal Year 2005–2006 violated the law and sought a partial refund. After the claim was deemed denied, Great Oaks filed a lawsuit that subsequently included an allegation that SCVWD's groundwater production charges violated Proposition 218, or Article XIIID of the state constitution because proceeds were claimed by Great Oaks to be allegedly used to fund projects and services that benefit the general public, not ratepayers. Great Oaks demanded a partial refund as well as declaratory, injunctive, and mandamus relief.

In February 2010, a Trial Court ruled that SCVWD owes Great Oaks a refund of groundwater charges, and also decided that SCVWD owes Great Oaks damages in the amount of $1,306,830. The Trial Court ruled that SCVWD failed to satisfy the notice and voting requirements of Proposition 218 and certain substantive provisions of Proposition 218, and that SCVWD violated the District Act when setting the groundwater charge. SCVWD appealed this decision to the Sixth District Court of Appeals.

In December, 2015, the California Court of Appeal for the Sixth Appellate District (Court of Appeal) reversed in full the judgment of the trial court in the Great Oaks case. The Court of Appeal found that under Proposition 218 SCVWD's groundwater charge is a "property-related fee," but also a fee for water service exempt from the voter ratification requirement. The Court of Appeal also found that the trial court erred when it found that the 2005–2006 groundwater charges failed to satisfy the applicable procedural requirements. The Court of Appeal also reversed the Trial Court's finding that SCVWD had failed to comply with the law in setting the groundwater fee. The effect of the Court of Appeals decision was to reverse the refund the trial court had ordered SCVWD to pay to Great Oaks, as well as reverse the awards of damages, pre-judgment interest, and certain other amounts. The Court of Appeal remanded the case to the trial court for proceedings consistent with its decision.

SCVWD and Great Oaks filed separate petitions for review in the California Supreme Court. The petitions were approved, and the case is currently pending before the California Supreme Court. Great Oaks has filed refund actions for subsequent years of annual groundwater charges, all of which are currently stayed.

*Water Rights Complaint Pending Before State Water Resources Control Board*
In July 1996, the Guadalupe Coyote Resources Conservation District (GCRCD) filed a complaint with the SWRCB alleging that SCVWD violated California Fish and Game Code Sections 5901, 5935, and 5937, the common law public trust doctrine, the Porter-Cologne Water Quality Control Act, and California Water Code Section 100. GCRCD alleges that SCVWD's water supply operations impact Steelhead Trout, Chinook Salmon, and other natural resources in or near the Coyote and Stevens Creeks, and the Guadalupe River and their respective tributaries. The complaint seeks to amend 14 of SCVWD's 17 local appropriative water right licenses and an appropriative water right permit to establish flow schedules sufficient for the protection of fish and wildlife resources and the development and implementation of a restoration plan.

In 1997, SCVWD commenced settlement negotiations with GCRCD, as well as with National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (FWS), California Department of Fish and Wildlife (CDFW), and other interested non-governmental nonprofit organizations (collectively referred to as the *Settlement Parties*) in an effort to resolve GCRCD's complaint. Settlement negotiations occurred through a SCVWD established process called the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE). On May 27, 2003, a conditional settlement was initialed by the Settlement Parties, which set forth a pathway to resolve the water rights complaint. This settlement agreement, entitled, *Settlement Agreement Regarding Water Rights of the Santa Clara Valley District on Coyote, Guadalupe, and Stevens Creeks* (FAHCE Settlement Agreement) committed SCVWD to carrying out certain conditions precedent, including completing an environmental review and obtaining state and federal regulatory approvals of certain SCVWD reservoir reoperations measures, scientific studies, and restoration measures (collectively referred to as the "FAHCE Restoration Program"), and amending SCVWD's challenged water rights and permit in substantial conformity to the FAHCE Settlement Agreement. Once the conditions precedent are completed, the FAHCE Settlement Agreement obligates SCVWD to carry out the FAHCE Restoration Program. Although SCVWD is not required to implement the FAHCE Restoration Program until the conditions precedent are completed, SCVWD has implemented a number of the restoration measures for the protection of fish and wildlife resources with the expectation of receiving credit toward its restoration requirements under the FAHCE Settlement Agreement.

To date, the conditions precedent have not been completed. From the date the FAHCE Settlement Agreement was initialed in May of 2003 to 2014, SCVWD actively pursued completion of the condition precedent of obtaining federal incidental take coverage of Steelhead Trout from NMFS under the Endangered Species Act (ESA) through a Habitat Conservation Plan. Once these conditions precedent are completed, SCVWD intends to carry out the FAHCE Restoration Program, while pursuing federal incidental take coverage of Steelhead Trout either through Section 7 or Section 10 of the ESA.[165]

## Discussion

The District's longstanding conjunctive management programs utilizing imported water halted land subsidence and increased groundwater levels across both the Santa Clara Sub-basin and the Llagas Sub-basin, all while supporting rapid population growth. Moreover, recent conservation efforts resulted in sharp reductions in cumulative water use relative to many regions of the state, with water use in 2015 down 27 percent when compared to 2013.[166] Current groundwater levels in the Santa Clara Sub-basin are roughly equivalent to where they were in the first two decades of the twentieth century, and higher than in the 1930s.[167] Groundwater levels in the Llagas Sub-basin also generally increased since the 1970s.[168] At the same time, SCVWD is involved in a wide range of water quality monitoring activities, with most monitoring sites reporting consistently high water quality. Though all these measures effectively stabilized groundwater levels and halted land subsidence, their continued success is highly dependent on a supply of imported water whose availability is increasingly threatened by climate change. Moreover, population is projected to increase from 1.8 million residents in 2010 to 2.4 million in 2035, with an estimated increase in demand from 378,000 AFY to 423,000 AFY.[169]

## Analysis

1. The SCVWD provides very comprehensive programs for water conservation, managed recharge, habitat protection, and pollution control. Ongoing groundwater recharge efforts have resulted in current groundwater levels in the Santa Clara Sub-basin being higher than their twentieth-century averages. Programs to identify and safely destroy abandoned wells have reduced the risk of saltwater intrusion and contamination from surface runoff, and there are free programs to provide water quality testing for privately operated domestic wells.

2. The SCVWD is dependent on imported water to meet its goals, with total Santa Clara County demand for groundwater higher than the rate of natural recharge. Though much of the county's demand is met directly with imported water, it is noted that long-term average pumping for the Santa Clara Sub-basin is 105,000 AFY, and natural recharge is 32,500 AFY.[170] The far southern portion of Santa Clara County is even more heavily dependent on groundwater production. Though managed recharge efforts have been under way in both sub-basins under SCVWD jurisdiction since at least the 1970s, any long-term disruption in the availability of imported water would cause both basins to revert to a state of overdraft. SCVWD does conduct extensive water level monitoring and has put ambitious conservation plans in place, however projected population growth in Santa Clara County will likely lead to an increase in net demand over the coming two decades. The SCVWD plans to meet increased future demands through further aggressive water conservation and expanded recycled water programs.[171]

3. Though smaller and less populous, the Coyote Valley and Llagas Sub-basin are very dependent on groundwater as a local drinking water source, and groundwater provides more than 90 percent of water used for all beneficial purposes. Water quality monitoring wells are less extensive in this region and the "opt-in" character of free water quality testing programs, means less consistent data are available on groundwater quality conditions in the Llagas Sub-basin compared to the Santa Clara Sub-basin. Moreover, nitrate concentrations in these areas are

consistently higher than in the urban north. Nonetheless, managing and reducing the potential for contaminants to enter the groundwater supply are ongoing challenges throughout SCVWD, with high levels of urbanization, large areas of non-permeable surfaces, and legacy contaminant release sites from earlier stages of industrialization, especially in industrial areas adjacent to the San Francisco Bay. Reducing the risks these present for groundwater contamination will require continued collaboration with regulatory agencies and political actors.

4. The SCVWD is working to bolster long-term water supply reliability and provide a drought-proof, locally controlled supply through the expanded use of recycled water. In 2014, SCVWD's $72 million Silicon Valley Advanced Water Purification Center came online. This facility produces up to 8 million gallons of advanced treated recycled water per day. This water is currently blended with tertiary treated recycled water to improve water quality for irrigation and industrial uses. This facility allows SCVWD to apply proven technologies to produce purified water, expanding the potential options for purified water use. The SCVWD 2012 Water Supply and Infrastructure Master Plan includes 20,000 AFY of advanced treated recycled water for potable reuse by 2030. The SCVWD is currently assessing the potential to use up to 45,000 AF of advanced treated water for groundwater recharge through ponds and/or injection wells.[172]

| Funding | Enabling Legislation |
|---|---|
| As a large, full-service District, SCVWD relies on a range of revenue sources to fund its operations:<br>1. **Program revenues from water sales:** The wholesaling of treated water to municipal water purveyors in Santa Clara County is the single greatest revenue source for SCVWD, followed by groundwater charge levies collected from private well operators for groundwater extractions in SCVWD groundwater charge zones.<br>2. **Property Tax Revenues:** SCVWD is partially funded by *ad valorem* property taxes levied on all property owners residing in Santa Clara County. SCVWD collects a State Water Project override tax to fund its monetary obligations in its long-term water supply contract with the California Department of Water Resources.<br>3. **Benefit Assessments:** Santa Clara County voters approved an additional levy in 1986 and 1990 to support financing for flood control capital improvements.<br>4. For information on grants, investment earnings, and miscellaneous revenue see: http://www.valleywater.org/About/CAFR.aspx | **Regulate pumping:** Yes, to the extent it is essential to carry out the express powers of its Enabling Act<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Carry out water transfers:** Yes<br>**Governing body elected by all the voters or just property owners:** Since 2010, Board of Directors are **elected by all registered voters living within the service area**, with each of the seven Directors representing one of Santa Clara County's seven supervisorial districts.<br>2006 revisions to the SCVWD enabling act eliminated the requirement for the County of Santa Clara Board of Supervisors to approve the SCVWD annual budget (AB 2435).<br>http://mountainview.granicus.com/MetaViewer.php?view_id=3&clip_id=97&meta_id=10710<br>See also:<br>http://www.valleywater.org/About/DistrictAct.aspx |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
|---|---|---|---|---|
| 54,000 AFY (natural rate of recharge – long-term average<br><br>>100,000 AFY (artificial recharge) | 149,000 AFY (total groundwater production for all areas under SCVWD purview) | Groundwater levels in some areas of the Santa Clara Basin were more than 150 feet higher in 2013 than at their low point in the mid-1960s.<br><br>Overdraft does not appear to be a significant current issue as long as SWP and CVP water continues to be available for direct and indirect groundwater recharge, and other conjunctive management, water conservation and recycling programs are maintained. | Since the arrival of SWP water in the 1960s and other conjunctive management efforts, groundwater levels have steadily climbed, coming close to their pre-modern levels by the early 21st century. | There are few widespread water quality issues service area, and those that do exist are either the result of farming practices (in the rural southern portion of the county) or due to longstanding pollution issues from the early/mid-20th century and are not a direct result of groundwater overdraft. |

# Alameda County Water District

## Overview

| | |
|---|---|
| **County** | Portions of Alameda County (including the cities of Fremont, Newark, Union City, and southern portions of the City of Hayward)[173] |
| **Area** | 104.8 sq mi (67,200 acres)[174] |
| **Population** | 343,499 (January 2015, served by ACWD)[175] |
| **CASGEM** | Niles Cone Sub-basin (Basin Number 2-9.01): Medium[176] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Alameda County Water District (ACWD) became the first independent water district in the state of California under the County Water District Act of 1913. ACWD manages the Niles Cone Groundwater Basin (NCGB) within its entire jurisdictional boundary and also retains jurisdictional authority of the Niles Cone Groundwater Basin within the areas that were detached to the City of Hayward through agreements. ACWD's service area and the Hayward Detachment areas roughly overlie the Niles Cone Sub-Basin (2-9.01), which the DWR defines as a structural feature of the larger Santa Clara Valley Groundwater Basin.[177] However, DWR's Bulletin 118 (2003) recognizes that the Niles Cone alluvial fan itself does have fairly distinct boundaries, which could lead it to be defined as a basin. In addition, the Hayward Fault cuts across the apex of the Niles Cone alluvial fan, which results in the impediment of westward flow of groundwater and separates the Niles Cone into two locally described sub-basins: the Above Hayward Fault (AHF) Sub-basin and Below Hayward Fault (BHF) Sub-basin. The difference in nomenclature between the DWR reports and the ACWD have prompted officials from both agencies to work together to develop a joint description of the (sub) basin's hydrogeology, while still allowing for differences in how each agency defines a "basin" and "sub-basin."[178] For the purposes of this report, we will follow ACWD practice by using the term "Basin" to refer to the Niles Cone (Sub) Basin, while the terms "sub-basin" will be used to refer to Above Hayward Fault and Below Hayward Fault regions of the Niles Cone (Sub) Basin.

The Niles Cone Basin exists almost exclusively within the ACWD's boundaries, certain aquifer layers of the Niles Cone appear to extend substantially beyond these boundaries.[179] It is bounded on the east by the Diablo Range, on the west by the San Francisco Bay, on the north by the boundary of ACWD and the areas located within the City of Hayward that were detached from ACWD in 1973, 2000, and 2004 (in order for the City of Hayward to provide water service while ACWD retained authority to manage the groundwater basin), and on the south by the Alameda-Santa Clara County line. Alameda Creek, the principal stream in the Basin, has meandered and occupied different locations within the Basin over geologic time, while Coyote Creek runs along the southern boundary of the Basin. The Basin is composed chiefly of the alluvial fan formed by Alameda Creek and its tributaries as it exits the Diablo Range and flows toward the San Francisco Bay, with some smaller alluvial fans around the edges of the Basin. Changes in the San Francisco Bay shoreline over the course of past interglacial cycles have created large aquifers interbedded with aquitards. The majority of water bearing materials is comprised of Quaternary-age alluvium though the Santa Clara Formation underlies a portion of the Basin along the eastern margins.[180]

The Niles Cone Groundwater Basin is recharged through (1) deep percolation of rainfall and applied water, and (2) percolation of water in Alameda Creek received at the District's groundwater recharge facilities (the primary source of recharge). Most of the water for this artificial recharge program is from Alameda Creek Watershed runoff, and the remainder is imported supplies released to tributaries of Alameda Creek. Water percolates into the groundwater basin through the stream channel bed and through the District's off-stream recharge ponds within the Quarry Lakes Regional Recreational Area (Quarry Lakes) and adjacent areas. The District utilizes inflatable rubber dams in the channel to divert water from the creek into the ponds.[181] The Quarry Lakes and dam-controlled channel impoundments straddle the Hayward Fault, thereby replenishing both the AHF Sub-basin and BHF Sub-basin. When one or more of the dams are inflated, impounded water may be diverted to recharge ponds, and percolation through the channel bottom is enhanced. The total water area of the recharge facilities at maximum capacity is 449 acres. In wet months and years, the source of water to the recharge facilities is mostly local water originating in the Alameda Creek Watershed, which is drained by Alameda Creek (which becomes the Alameda Creek Flood Control Channel downstream of Niles Canyon). In dryer months or years, ACWD uses imported State Water Project (SWP) water for groundwater recharge, delivered to Alameda Creek via the South Bay Aqueduct.

Significant differences in water level on either side of the Hayward Fault, that cuts across the apex of the Niles Cone alluvial fan and separates the Basin into the AHF and BF sub-basins, indicate the relative impermeability of the Hayward Fault. Pleistocene to recent-age alluvium is the most significant water-bearing unit in the Basin, consisting of unconsolidated gravel, silt, sand, and clay. The AHF sub-basin is conceptualized as a single aquifer that is both confined and unconfined, due to the presence of local low permeability layers. The BHF sub-basin is composed of a series of west-dipping aquifers interspersed with clay aquitards. These aquifers are composed of gravels and sands deposited by ancestral Alameda Creek as fluvial and alluvial deposits. By order of depth, they are the Newark Aquifer, Centerville Aquifer, Fremont Aquifer, and Deep Aquifers. To the east, beginning near the Quarry Lakes and the Hayward Fault and extending to some distance outward, the Newark Aquifer is unconfined, and over this area the Newark Aquifer is substantially recharged. The deeper aquifers are generally considered confined throughout the BHF; however, to the east, especially near the Quarry Lakes, the aquitards separating the vertically stacked aquifers are relatively thin and permeable, enabling rapid replenishment of the deeper aquifers (referred to as the forebay area). The grain size and thickness of the aquifers decrease westward, while the intermediary aquitards become thicker

Although the easterly San Francisco Bay shoreline more or less defines the western limit of the ACWD-managed Niles Cone Basin, the Alameda Creek alluvial fan is believed to extend under San Francisco Bay and reach the west shoreline of San Francisco Bay. Logs of borings advanced to a depth equivalent to the top of the Centerville Aquifer indicate the presence of the Newark and Centerville Aquifer. Deeper boring logs on either side of the bay indicate that similar extension of the Deep Aquifers is plausible, while the Fremont Aquifer may truncate on the east side of the bay. To the north, the Deep Aquifers of the Niles Cone Basin interconnects with a counterpart Deep Aquifer in the East Bay Plain Sub-basin through a transition zone which demarks the two basins.

Land use in the ACWD is primarily municipal (i.e., residential and commercial) and salt ponds and marshes with a small amount of industrial.[182] ACWD's service area includes the Cities of Fremont, Newark, Union City, and the southern portion of the City of Hayward. The only detachments in the northern extent of ACWD's boundary (within the southern portions of the City of Hayward) occurred in 1973, 2000, and 2004, when the ACWD worked cooperatively with the City of Hayward to detach (through the Alameda County Local Agency Formation Commission) properties in order for the City of

Hayward to provide water service while ensuring (through agreements) that ACWD retained authority to manage the groundwater basin. ACWD has the authority to provide retail water service within its service area, except for the areas that were detached to the City of Hayward. However, currently, ACWD provides retail water service predominately within the Cities of Fremont, Newark, and Union City. Through agreements, ACWD does provide retail water service to some parcels within the City of Hayward, and likewise, the City of Hayward provides retail water service to some parcels within ACWD's service area.

## Background to District Formation

The earliest European settlement in the region was the Mission San Jose, established by Franciscan priests in 1797. After 1821, other European settlers began arriving in the area, forming an agricultural community that would last for nearly 100 years. Throughout the nineteenth century, the free-flowing Alameda Creek supplied sufficient water for agriculture, while a number of artesian wells were also readily accessible.[183] However, by the early twentieth century, urbanization in the Bay Area sparked a water shortage in the region, with the Spring Valley Water Company piping water from the Niles Cone Basin to San Francisco and the People's Water Company diverting Niles Cone Basin water to residents of Oakland. By 1910, local residents took on the battle to return water rights to the local people of the area. Continuing growth in the Bay Area had caused the water table to drop to its lowest level in history, with the groundwater level dropping by more than an inch per day. It was decided that the formation of a water district was an absolute must, and on December 30, 1913, residents went to the polls and approved the formation of such a district by the overwhelming majority of 883 to 18 votes. ACWD spent most of the first two decades of its existence enmeshed in a string of legal battles trying to wrest control of the Niles Cone Basin water from external water companies.[184]

## Dates

**Creation of the Special District:**
Dec 30, 1913 – ACWD was created by a vote of area residents. Its enabling legislation was the Caminetti Act, and it was the first water district founded in California.
March 31, 1914 – Board of Directors is elected.
**Additional Authority:**
1961 – Replenishment Assessment Act of the Alameda County Water District (Chapter 1942 of the Statutes of 1961, as amended in 1970 and 1974). Additional powers granted under the Replenishment Assessment Act of the Alameda County Water District.[185]
2001 – ACWD's Groundwater Management Policy (Policy) adopted on January 26, 1989 (prior to Assembly Bill 3030) and as amended on March 22, 2001, was formally adopted by ACWD's Board of Directors through Resolution No. 01-021 (prior to Senate Bill 1938).[186]
2010 – ACWD Groundwater Protection Act[187]
2014 – ACWD is deemed to be the exclusive local agency to comply with the Sustainable Groundwater Management Act.[188]

## Special District Summary

As the oldest Special District in California, the ACWD has seen the scope of its activities and its jurisdictional authority expand over the course of its history. For the first 17 years of its existence, the ACWD expended most of its efforts trying to shore up local control of the water resources of the Niles Cone Basin through a series of protracted lawsuits against diversion by outside water companies.[189] It was not until 1920 that ACWD secured rights to the Alameda Creek Watershed for recharge of the Niles Cone Basin, although lawsuits and disagreements ensued through the 1920s. The year 1930 marked another critical milestone, as ACWD took ownership of a wellfield putting ACWD in the water distribution business for the first time in its history. The period from the 1930s into the 1950s saw a rapid expansion in the purchase and construction of water distribution systems, which was coupled by rapid population growth and increasing urbanization, especially in the years immediately following World War II.[190] Rapid development in the Postwar era saw increasing concerns around water scarcity, and prompted ACWD officials to collaborate with the state and outside agencies to secure a reliable supply of imported water.

In 1961, ACWD signed a contract with the California Department of Water Resources (DWR) for water from the State Water Project (SWP), and it became the first water purveyor in the state to receive SWP water with the completion of the South Aqueduct in 1962.[191] The District's SWP supply was originally used solely to recharge the groundwater basin. As a result, groundwater levels rose and prevented additional saltwater intrusion. However, certain areas within the groundwater basin remain brackish due to past years of saltwater intrusion.[192] A contract with San Francisco followed in 1964, granting the ACWD access to the Hetch Hetchy water supply and reducing the strain on local groundwater resources during an era of unprecedented growth and urbanization.

In addition to the powers granted through the Caminetti Act, the Replenishment Assessment Act (Act) grants the ACWD broad and wide-ranging authority to replenish the groundwater of the District and prevent saline intrusion into the District's groundwater aquifers. The Act stipulates that the District may perform any act necessary to replenish the groundwater of the District or to prevent saltwater intrusion into the groundwaters of the District, including any of the following:

1. Buy and sell water.
2. Exchange water.
3. Distribute water to persons in exchange for ceasing or reducing groundwater extractions.
4. Spread, sink, and inject water into the underground.
5. Store, transport, recapture, reclaim, purify, treat, or otherwise manage and control water for the beneficial use of persons or property in the District.
6. Build the necessary works to achieve groundwater replenishment or the prevention of saltwater intrusion.
7. Put to beneficial use any water subject to the control or management of the District.[193]

Fees for municipal and industrial water provision and property tax revenues are the two major sources of income for the District.[194]

ACWD has three primary sources of water supply: (1) the SWP, (2) San Francisco's Regional Water System, and (3) local supplies. Local supplies include fresh groundwater from the NCGB, desalinated brackish groundwater from portions of the groundwater basin previously impacted by saltwater intrusion, and surface water from the Del Valle Reservoir.[195]

Over the FY1999/00–FY2009/10 period, the total in-District water demands (distribution system and groundwater system demands) were met by: SWP supplies (27 percent), San Francisco Regional Water System supplies (19 percent), and local supplies (54 percent). Over the same time period, water demands for only the distribution system (potable) were met by: SWP supplies (~35 percent), San Francisco Regional Water System (~ 25 percent), and local supplies (~40 percent).[196] On average, groundwater accounts for 40 percent of ACWD's distribution system supply, and in times of drought, can account to up to 60 percent.[197]

## Water Users

The profile of water users within ACWD's service area has undergone a shift since the District's early years. While Washington Township and the surrounding areas were overwhelmingly rural and agricultural at the time of the ACWD's inception in 1913, today ACWD's service area (which includes the cities of Fremont, Newark, Union City, and the southern portion of the City of Hayward) and the Hayward Detachment Areas are heavily (sub) urbanized, with barely any agricultural use remaining. Today, the District provides water primarily to urban customers: approximately 70 percent of supplies are used by residential customers, with the balance (approximately 30 percent) utilized by commercial, industrial, institutional, and large landscape customers. The overall breakdown of consumption of water delivered from ACWD's distribution system in 2012 is as follows: Residential – 30,887 AF (~70 percent); Business/Commercial – 6,167 AF (~14 percent); Industrial – 3,857 AF (~9 percent); Miscellaneous – 2,946 AF (~7 percent). Outdoor recreation is named as one of the main water uses for the Miscellaneous category.[198]

In 2012, approximately 2,000 AFY was produced from private wells operating within the ACWD-managed NCGB, approximately 4 percent of total water production—this figure is a significant drop from earlier in the twentieth century, when private well operation was a significant source of groundwater extraction across the region. Moreover, since 2012, private well production dropped four-fold over the first decade of the twenty-first century.[199] A major reason for the decline in private pumping is that large-scale farming no longer exists within the heavily urbanized service area of the ACWD. Currently, only about 200 AFY of groundwater is pumped for agricultural use. Other private (non-ACWD) pumping includes city and non-city park recreation use, industrial use, and domestic use. A small amount of groundwater pumping for other domestic and/or irrigation purposes is not recorded by ACWD.[200]

## Management Structure

A five-member Board of Directors governs ACWD. Registered voters living within ACWD's boundary elect each member to staggered four-year terms.[201] Unlike many other Special Districts in California, ACWD's directors do not represent any specific constituency or subdivision within the District, but rather are selected by registered voters at-large. The procedure for direct elections of ACWD Board members was established by its enabling legislation, the Caminetti Act of 1913, and has remained unchanged over the 100 years of ACWD history, despite profound shifts in the demographics of the region and a broad expansion of ACWD's legal authority to manage water resources.[202] The Board of Directors directly oversees the General Manager, who, in turn, is responsible for the oversight of the Office of the General Manager and ACWD's four departments: engineering and technology services, finance, operations and maintenance, and water resources.[203] Taken together, ACWD employs a total of 230 people, with a majority (118) employed in the operations and maintenance division.

## Management Strategies

### Early Strategies

*Imported water*
ACWD receives imported water for its distribution system (potable) from the SWP (~35 percent) and from the San Francisco Regional System (~25 percent). This water is either treated at one of ACWD's two water treatment plants or used to recharge local aquifers.[204]

*Groundwater recharge*
The 1961 Replenishment Assessment Act facilitated ACWD's expansion of managed aquifer recharge operations. From 1930 to the mid-1970s, ACWD added off-stream recharge ponds to augment percolation in the Alameda Creek bed. The Western Gravel Pit was acquired in the mid-1930s. A number of other pits were acquired or leased in the late 1940s and 1950s. The current configuration of recharge ponds followed transfer of then remaining quarry pits to ACWD and the East Bay Regional Park District (EBRPD) in the 1970s. ACWD and EBRPD cooperated to form a complex that serves both park and groundwater replenishment.

Diversion of water into the complex of recharge ponds was greatly facilitated by replacement of temporary earthen dikes with installation of inflatable rubber dams. In 1972, the ACWD installed Rubber Dam No. 1, marking the first such installation anywhere in the United States; it was the world's largest inflatable dam at the time of its completion.[205] Rubber Dam 2 and then Rubber Dam 3 would later be added. Rubber Dam 2 would eventually be decommissioned to accommodate efforts to restore a Steelhead trout fishery in the Alameda Creek Flood Control Channel. Fish ladders are planned to enable fish passage around Rubber Dams 1 and 3, which will remain in operation.[206]

*Salinity control*
Fairly unimpeded contact between bay water and the Newark Aquifer occurs through vertical pathways in sediment under the bay, and possibly, in adjacent sloughs or marshes. Thus, subsurface discharge from the Newark Aquifer to the bay occurs when piezometric heads in the Newark Aquifer are above sea level, and in reverse, saltwater intrusion occurs when Newark Aquifer heads are below sea level. In the early to mid-twentieth century, the basin was overdrafted and suffered decades of saltwater intrusion. Brackish water in the part of the Newark Aquifer under the bay and salt ponds migrated inland, eventually reaching the Hayward Fault, and flowed downward to deeper aquifers.

In the mid-1970s, piezometric heads in the Newark Aquifer were restored above sea level, marking the beginning of a long, ongoing recovery as brackish groundwater in the Newark Aquifer has been gradually repulsed back toward San Francisco Bay over a broad front. In addition, the Aquifer Reclamation Program (ARP) was instituted in the 1970s upon realization that brackish water in the deeper aquifers is essentially trapped, and could be further drawn inland by wellfield pumping. Some brackish water was also pumped from the Newark Aquifer under the ARP. Despite success in restoring groundwater levels through improvements in managed aquifer recharge, levels in the Newark Aquifer could temporarily fall below sea level in times of drought, causing new seawater intrusion.[207]

*Desalination*
ACWD's groundwater supply facilities include several wells that extract from parts of the basin still impacted from legacy saltwater intrusion, plus two well fields that pump fresh water. Pumped brackish

water is treated by reverse osmosis at ACWD's desalination facility before it is provided as a potable water supply.

Pumped ARP water was originally considered as having no beneficial use, and was discharged to San Francisco Bay. This changed with completion of the Newark Desalination Facility in 2003, and expansion of the facility in 2009. Currently, almost all ARP water is routed to the desalination facility for potable use. The Newark Desalination Facility, with a current capacity of 10 million gallons per day permeate, uses reverse osmosis filters to create high quality potable water. This further expanded the ACWD's water supply portfolio by making treated brackish groundwater available to ACWD's customers. Recharge, salinity control and the desalination facility enabled the ACWD to recharge the Niles Cone Basin with a combination of local runoff, chiefly from Alameda Creek, and imported SWP water.[208]

### Current Strategies

ACWD's current set of strategies to replenish and manage the groundwater basin was first adopted in 1989 and further amended in 2001. Revised elements of these strategies have also been incorporated in the District's 2010–2015 Urban Water Management Plan (UWMP) and Integrated Resources Plan (IRP) of 2014. The ACWD's Groundwater Management Policy seeks to meet the following goals:

- Increase groundwater replenishment capability
- Increase usable storage of the groundwater basin
- Operate the basin to provide reliable and emergency sources of supply
- Protect groundwater quality from any and all sources of contamination, including, but not limited to: saline intrusion, wastewater discharge, urban and agricultural runoff, and chemical contamination
- Improve groundwater quality by removing salts and other contaminants from affected areas of the basin and improve the quality of imported water used in groundwater recharge[209]

To achieve these goals, ACWD currently operates eight distinct groundwater management programs, which include: water supply management, groundwater replenishment, watershed protection and monitoring, basin monitoring, wellhead protection, aquifer reclamation, groundwater protection, and well ordinance administration.[210]

*Conjunctive use of surface and groundwater*
The groundwater basin is managed conjunctively with surface and imported water supplies. Water from the Alameda Creek Watershed and the SWP is used to recharge the groundwater basin, and, in years with precipitation levels near historical averages, the recharge rate is an estimated 33,000 AFY.[211] ACWD conducts an annual survey of groundwater conditions to determine the amount of imported water needed to maintain groundwater levels within an acceptable range and establish an annual replenishment rate. Well operators who pump groundwater from the basin are required to pay a replenishment assessment to reimburse ACWD the costs of groundwater recharge operations and groundwater management and protection programs.[212] Groundwater replenishment is achieved through two inflatable rubber dams located within the Alameda Creek Flood Control Channel, which store and percolate water into the aquifers of the Niles Cone Basin.[213]

*Pollution control*
To reduce the risk of groundwater contamination from abandoned and poorly maintained wells,

ACWD educates the public about the risk of abandoned wells, provides resources to identify and oversee the destruction of wells that are no longer in operation, and issues permits and conducts inspections for all well construction and modifications within the boundaries of the cities of Fremont, Newark, and Union City.[214] Alameda County Public Works Agency oversees the construction and destruction of wells in the City of Hayward.
To protect existing groundwater resources from contamination, ACWD takes an active role in assisting regulatory agencies and industry identify potential sources of contamination, implements monitoring programs at hazardous materials storage sites, and provides technical oversight and assistance for investigating and cleaning up leaking fuel tanks, underground spills, and other potential sources of contaminants that may threaten groundwater aquifers.[215]

*Water banking*
ACWD has a contract with Semitropic Water Bank to send its surplus SWP water to the bank during wet years, which it can then recover during dry years.

## Monitoring and Reporting

The establishment of the replenishment assessment required that meters be installed on wells in the District. While the Board could defer this requirement on a year-to-year basis if justified, the Board chose to install the necessary water meters on most wells in FY 1970/71 and FY 1971/72. Additional meters have been installed as necessary for new or reactivated wells. Of the 59 non-ACWD-owned wells with active accounts in the replenishment assessment program, all except two, identified as wells 4S/1W-20R02 and 5S/1W-03C07, are also currently equipped with meters. [216]

The District performs weekly monitoring of water level measurements of representative wells in each major aquifer to measure and respond to changes in the groundwater table. These wells are monitored regularly for a variety of water quality indicators, while the District coordinates with other neighboring water districts and local and regional public agencies to ensure an integrated and coordinated effort to monitoring potential threats to the watershed at large.[217]

The Spring/Fall Groundwater Monitoring Program, established in 1961, is a semi-annual field effort to document the status of wells, obtain water level measurements, and collect groundwater samples.[218] The Program provides critical information used in the management of ACWD's groundwater resources. As of fall 2014, ACWD monitors groundwater levels in 261 wells within its 104 square mile service area and collects water quality data from 184 of those wells.[219] ACWD operates its own California Environmental Protection Agency-certified laboratory where it conducts water quality testing of the groundwater samples collected.

ACWD is also the local enforcement agency for wells, exploratory holes, and other excavations, and has passed a comprehensive set of regulations requiring permitting, metering and inspections for all wells.[220] Well Ordinance 2010-01 has 37 pages of regulations going beyond basic permitting and metering requirements to include specific restrictions and guidelines on permissible sealing materials, conductor casings, and location with regard to other potential sources of contamination.[221] Privately operated wells constitute a tiny fraction of total water withdrawals within the ACWD service area, and have declined steadily as a groundwater production source since the early years of ACWD.

## Safe Yield

The annual rate of recharge is estimated at 33,000 AF in a year where precipitation totals come close to their historical averages. During the period 1993–2010, the water year 1997/98 saw the highest rate of recharge, estimated at 58,000 AF, while the water year 2007/08 saw the lowest rate of recharge, estimated at 24,000 AF.[222] A summary of groundwater pumping, recharge, and change in storage is provided in Table 14.

**Table 14: Groundwater Budget for the Niles Cone Groundwater Basin (AFY)[223]**

| Item | Fiscal Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 |
| **Total Net Recharge(1)** | 41,500 | 32,400 | 31,600 | 28,500 | 32,400 | 33,900 | 18,200 | 13,000 | 17,300 | 31,000 |
| | | | | | | | | | | |
| **Pumping** | | | | | | | | | | |
| Production Wells | 17,500 | 18,500 | 14,800 | 14,200 | 15,300 | 12,100 | 10,500 | 8,900 | 8,300 | 5,900 |
| ARP Wells | 11,600 | 9,900 | 6,600 | 4,900 | 7,000 | 11,300 | 12,000 | 11,000 | 11,400 | 11,200 |
| Private Wells | 3,000 | 3,000 | 2,200 | 2,100 | 1,900 | 2,000 | 2,600 | 1,900 | 2,000 | 2,000 |
| **Total Pumping** | 32,100 | 31,400 | 23,600 | 21,200 | 24,200 | 25,400 | 25,100 | 21,800 | 21,700 | 19,100 |
| | | | | | | | | | | |
| **Saline Groundwater Outflows** | 8,400 | 6,800 | 7,400 | 7,400 | 6,800 | 6,100 | 4,700 | 3,600 | 300 | 2,200 |
| | | | | | | | | | | |
| **Change in Storage** | 1,000 | -5,800 | 600 | -100 | 1,400 | 2,400 | -11,600 | -12,400 | -4,700 | 9,700 |

Note: (1) Total Net Recharge is calculated as recharge from deep percolation of rainfall and applied water plus recharge at the District's groundwater percolation facilities (including recharge of imported water) less the sum of evaporation losses and "Other Outflows" (as described in the District's annual Groundwater Survey Reports).

## Groundwater Pumping and Overdraft

Groundwater overdraft reached its most serious levels during the first 60 years of the twentieth century. In 2010, however, groundwater levels were at the highest since the first decade of the twentieth century. The water table in the Niles Cone Basin first dropped below sea level around 1920, leading to saline intrusion into parts of the western aquifer along the San Francisco Bay. By 1930, this level had fallen to more than 30 feet below sea level; a trend that was briefly reversed after court decisions to halt the export of water outside ACWD boundaries. Rapid growth and urbanization in the 1940s and 1950s caused the water table to start dropping once again, with the lowest recorded groundwater level (67.8 feet below sea level) reached in 1961, the year before the ACWD began importing water from the SWP.[224]

Groundwater levels generally began to rise after the completion of the South Bay Aqueduct, a trend that would accelerate further after the completion of the first inflatable dams to enhance the rate of groundwater recharge.[225] Groundwater levels in the Niles Cone Basin have remained consistently above sea level from the early 1970s through the early 2010s, with some annual fluctuations, due to normal water supply operations.

In recent years, ACWD has reduced the level of its reliance on imported water for aquifer recharge through demand reduction programs and the development of brackish groundwater desalination. Unlike in the past, the overwhelming majority of ACWD water consumers receive their water through ACWD's distribution system, with a very limited number of private wells that pump directly from the Niles Cone Basin.[226]

Groundwater pumping for Fiscal Year (FY) 2014/15 (actual) was 19,000 AF. Most of the FY 2014/15 groundwater production figures were obtained from well meter readings. A small amount of unmetered groundwater production was estimated. The annual overdraft is defined in ACWD's Replenishment Assessment Act as the difference between the amount of pumping of groundwater from the basin and the amount of water recharged from local water supplies for the fiscal year. The net local water recharged to the groundwater basin is composed of the portion of applied water (e.g., irrigation) and rainfall that percolates to the groundwater basin, plus the portion of watershed runoff impounded at the recharge facilities, less evaporation of such impounded water, and less saline and other outflows from the basin. Overdraft during Fiscal Year 2014–2015 was 2,000 AF.[227] This overdraft, however, was compensated for by recharge with imported water.

The accumulated overdraft is defined in the Replenishment Assessment Act as the amount of water necessary to be replaced in the groundwater basin to prevent the landward movement of bay water into the fresh groundwater basin. This applies only to the Below Hayward Fault Sub-basin. As stated in the 2016 edition of ACWD's annual Survey Report, "the accumulated overdraft of the basin has been eliminated since early 1972… water levels in the Newark Aquifer are expected to remain above sea level through FY 2015/16 and for the entire FY 2016/17." Hence, no accumulated overdraft is expected through at least FY 2016/17.[228]

## Water Quality

Water quality has generally improved since the introduction of imported water to recharge the aquifers of the Niles Cone Basin. Saline intrusion into the portions of the service area adjacent to the San Francisco Bay was a significant concern during the first half of the twentieth century when the Niles Cone Basin was in a perpetual state of overdraft. Aquifer reclamation projects have led to significant drops in chloride concentrations across much of the Niles Cone Basin, with the sharpest declines experienced in the shallow Newark Aquifer, directly adjacent to the San Francisco Bay.[229]

A decrease in chloride and total dissolved solids (TDS) concentrations near the recharge ponds and some distance toward the bay is observed in the BHF Aquifers. However, an increase in chloride and TDS is also observed in areas surrounding historically impacted areas in the Centerville-Fremont and Deep Aquifers. ACWD suggests this increase may be due to mixing of high-salinity water with lower-salinity water as infiltration from the recharge area dilutes and disperses the saline water.[230] However, overall saline intrusion has been halted across the Niles Cone Basin with average levels much lower today than in the 1960s when the Replenishment Assessment Act and the Spring/Fall Groundwater Monitoring Program were initiated.

## Disputes

ACWD was involved in a number of legal disputes over the course of its more than 100-year history. The most contentious period was the first 20 years of ACWD history, when officials fought a number of legal battles to wrest control of local water resources from private water companies that were exporting it to San Francisco and Oakland. In more recent years, ACWD has responded to neighboring agencies' plans for groundwater development projects to ensure that they do not lead to undue induced outflows from the Niles Cone.

ACWD also joined a class-action lawsuit against Formosa Plastics, a manufacturer of PVC piping ACWD has used in construction, over allegations that Formosa Plastics provided false information about the quality of its pipes, which needed to be replaced much sooner than expected. The courts ruled in favor of the plaintiffs and ACWD, along with several other public water districts, were awarded damages. This lawsuit have was not about water rights.

Additionally, gravel quarrying companies had taken advantage of low groundwater levels to excavate gravel from deep pits in the Niles area of Fremont, and the dewatering operations were defeating ACWD's efforts to percolate water in the basin. Following a landmark court decision won by ACWD, the gravel companies ceased operations and sold their pits to ACWD and the East Bay Regional Park District. ACWD converted these pits into groundwater recharge ponds.[231]

## Discussion

The NCGB was one of the most heavily threatened groundwater reserves in the early years of the twentieth century, which is a primary reason why the ACWD was the first independent Special District in California. Despite early successes, groundwater levels continued, on average, to drop across the NCGB until the importation of SWP water in 1962. The construction of inflatable dams from the 1970s to 1980s and the conversion of former quarries into recharge ponds increased the rate of groundwater replenishment using local surface water resources, though the ACWD remains reliant on imported water to recharge its groundwater basin. The reliability of the District's imported SWP supplies, however, will continue to remain uncertain due to the ongoing concerns regarding the sustainability of the Delta.[232] The ACWD's longstanding conjunctive management programs, its continued reliance on imported water for groundwater recharge, and its efforts to develop local alternatives to imported water, have created the conditions for the water table in the aquifers of the NCGB to rise back to their nineteenth- and early twentieth-century levels.

Today, the ACWD emphasizes demand management programs, is evaluating non-potable water supply alternatives, and has increased the use of brackish groundwater desalination to optimize its use of local water resources without leading to precipitous drops in the water table.[233] Groundwater levels have remained within normal operating range during the drought, groundwater levels remain above sea level across the NCGB and were, on average, more than 80 feet higher during the first decade twenty-first century than they were at their low point during the 1950s and 1960s.[234]

## Analysis

- In terms of maintenance of groundwater levels, ACWD is one of the more successful Special Act Districts in California, with average groundwater levels today returned to levels at the beginning of the century. Though the water table dropped precipitously during the first half of the ACWD's existence, the arrival of imported water and investments in subsequent infrastructure have allowed for aquifer recharge to reach levels not seen since the first decade of the twentieth century.

- While ACWD has actively sought to augment ways to use local water resources to meet local needs and recharge the groundwater basin, imported water remains a significant part of the ACWD's portfolio, and it currently supplies about 46 percent of the District's total distribution and groundwater system demands. The reliability of SWP supplies for ACWD during dry years was significantly enhanced by ACWD's water banking agreement with the Semitropic Water Storage District. However, the increased cost and decreased reliability of imported water may be a problem in the future.

- The profile of water users has shifted during the 100 years of ACWD's existence. Today, large-scale agriculture is entirely absent within ACWD's service area. Population growth is expected to continue over the coming few decades, though the rate of growth is slower now than in the mid-twentieth century. Continued investment in new technologies and conservation programs are striving to reduce the reliance on imported water and cap total levels of consumption.

- ACWD stands out for very actively managing its groundwater with the goal of improving its groundwater resources for the benefit of both its customers and private well owners, and by taking actions designed to increase groundwater replenishment capability and usable storage capacity, and both meeting demand and reserving storage to augment dry year supplies.

| Funding | Enabling Legislation |
|---|---|
| **The seven main revenue sources include:**<br>**1. Water Revenue:** ACWD's main source of funding comes from the fees it charges its customers for municipal and industrial water provision. As a primarily urban district, nearly all water is distributed through ACWD's public distribution system, which accounted for roughly 84 percent of District revenue in FY 2015/16.<br>**2. Property Taxes:** Property taxes account for roughly 8 percent of District revenue in FY 2015/16, and are assessed based on property value.<br>**3. Facilities Connection Charges**<br>**4. Investment Income**<br>**5. Fees and Rentals**<br>**6. Other Operating Revenues**<br>**7. Other Non-Operating Revenues** | **Regulate pumping:** Yes<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body:** At-large Board of Directors **elected by all registered voters living within the service area.** |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
|---|---|---|---|---|
| 8,400 AFY (non-managed natural recharge rate in median precipitation year )<br><br>33,000 AFY (artificial recharge rate in median precipitation year using currently existing technologies and infrastructure). Most of this includes local Alameda Creek Watershed runoff, not imports.<br><br>Annual recharge data are available for the period 1980–2010. The lowest rate of total recharge on record is 24,000 AFY, while the highest rate was 58,800 AFY during the El Niño winter of 1997/98.<br><br>The 2015 annual report indicates that these figures were lower in the 2012–2015 drought. | 2012: ACWD provided 43,856 AFY through its own distribution system, while another 1,900 AF were produced through privately operated wells located within ACWD's service area.<br><br>60 percent of ACWD's total potable water budget is met with imported water, while 40% is met with local water resources. Groundwater is extracted and blended with imported water sources before being delivered to consumers through the ACWD's municipal distribution system.<br><br>About 20,000–30,000 AFY of local surface water flows are then artificially diverted and pumped back into the aquifer. | Groundwater levels in the Newark Aquifer reached a low of 60 feet below sea level in the early 1960s. They rebounded to nearly 20 feet above sea level in the mid-2000s after ACWD began importing SWP water in the 1960s. The maximum operating limit for the Newark Aquifer (as measured in the forebay) is approximately 20 feet.<br><br>Current levels are roughly 5–10 feet above sea level, nearly 70 feet higher than they were when ACWD first began importing SWP water.<br><br>Levels dropped somewhat during the 2012–2015 drought.<br><br>Operating levels in the AHF are higher than the BHF. | Accumulated overdraft was erased in 1972.<br><br>During the height of the recent drought, groundwater extraction exceeded recharge. Some of this was intentional as ACWD sought to lower water levels to accommodate construction in the Quarry Lakes area. However, heads in the Newark Aquifer did not fall below sea level. In 2016, water levels rebounded to their maximum operating limits.<br><br>While groundwater levels are much higher today than in the recent past, the continued reliance on SWP water means that overdraft could still occur in a severe and lengthy drought. | Saline intrusion occurred in parts of the aquifer due to overdraft in the early and mid 20th century. While this process was halted and reversed in the latter part of the 20th century, areas with high levels of salt and TDS remain in areas of the aquifer adjacent to San Francisco Bay. Progress in reclamation, however, continues, with above sea level operation of the Newark Aquifer and desalination ARP pumping. |

# Alameda County Flood Control and Water Conservation District, Zone 7

## Overview

| | |
|---|---|
| **County** | Eastern portions of Alameda, including Livermore, Pleasanton, Dublin, Dougherty Valley, and adjacent unincorporated areas[235] |
| **Area** | 109 sq mi (surface area of Livermore Groundwater Basin)[236] and 425 sq mi (total area under Zone 7 flood control jurisdiction)[237] |
| **Population** | 237,000[238] |
| **CASGEM** | Medium[239] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Livermore Valley Groundwater Basin is an inland alluvial basin underlying the east-west trending Livermore-Amador Valley (Valley) in northeastern Alameda County. The Valley, which extends approximately 14 miles in an east-west direction and varies from three to six miles in width, is surrounded primarily by north-south trending faults and the hills of the Diablo Range. The Livermore Valley Groundwater Basin underlies the heart of the Valley and extends south into the uplands south of Pleasanton and Livermore.[240] Groundwater generally flows from the southeast and east toward the west, with the highest yielding, best-quality aquifers found beneath a portion of the Livermore Valley Groundwater Basin known locally as the Main Basin.[241] The Main Basin is itself comprised of the Castle, Amador, Bernal, and Mocho II Sub-basins and is hydraulically connected to the less productive fringe areas through the shallow alluvium layer.[242] However, subsurface inflow from the fringe sub-basins into the deeper portions of the Main Basin is believed to be a relatively small annual average of approximately 1,000 AF. These deeper aquifers of the Main Basin are primarily recharged through the vertical migration of groundwater within the Main Basin itself and serve as the exclusive source of municipal well water supplied within Zone 7 service area.[243]

Groundwater-bearing materials in the Livermore Valley Groundwater Basin include deposits from alluvial fans, streams, and lakes of Pleistocene-Holocene age that range in thickness from only a few feet along the margins to more than 800 feet in the west-central portion of the Main Basin. This alluvium consists of unconsolidated gravel, sand, silt, and clay. The Pleistocene-age Livermore Formation is found beneath the alluvial layer, consisting of clayey gravels and sands, silts, and clays that are unconsolidated to semi-consolidated. The degree of contact between the overlying alluvium layer and the Livermore Formation is almost impossible to discern from drill cuttings and electrical logs, but the Livermore Formation itself is believed to extend up to 4,000 feet deep beneath the southern and western portions of the Livermore Valley Groundwater Basin.[244] The Pliocene-age Tassajara and Green Valley Formations underlie the Tassajara Uplands located to the north of the Livermore Valley. These water-bearing formations consist chiefly of sandstone, tuffaceous siltstone, conglomerate, shale, and limestone, but remain hydraulically isolated from the Main Basin by a series of angular faults and stratigraphic disconformities, and thus are not a significant source of water for the

Alameda County Flood Control and Water Conservation District (AFCWCD), Zone 7 (hereafter Zone 7) consumers.[245]

Although multiple aquifers have been identified within the Main Basin alluvium, District wells are classified as belonging to either the Upper Aquifer Zone (UAZ) or the Lower Aquifer Zone (LAZ), which are separated by a relatively continuous silty clay aquitard that reaches up to 50 feet in thickness. The UAZ consists of alluvial materials, including sandy and clayey gravels, which are usually found beneath a confining surficial clay layer ranging from 5 to 70 feet below the surface and extending to a depth of approximately 80 to 150 feet below the surface. Groundwater in this zone is generally unconfined, but can become confined in portions of the western Basin when water levels are high. The LAZ consists of all sediments beneath the clay aquitard in the center portion of the Basin. These aquifer materials consist of semi-confined to confined, coarse-grained water bearing units interbedded with relatively low-permeability fine-grained units. It is believed that the LAZ derives most of its water from the UAZ through the clay aquitard when piezometric heads in the UAZ exceed those in the lower zone.[246]

Zone 7 is the water wholesaler for the Livermore-Amador Valley, also commonly referred to as the *Tri-Valley.* It supplies treated water to four retail water supply agencies: California Water Service Company – Livermore District (Cal Water), Dublin San Ramon Services District (DSRSD), City of Livermore (Livermore), and the City of Pleasanton (Pleasanton). These retailers deliver water for municipal and industrial (M & I) purposes within their individual service areas, which include the cities of Livermore, Pleasanton, Dublin, and a portion of San Ramon (Dougherty Valley).[247]

## Background to District Formation

Major settlement of the Livermore Valley began during the second half of the nineteenth century, with Livermore becoming the first incorporated city in the Valley in 1876. Early settlers planted numerous vineyards across the Livermore Valley, irrigated by well water and natural rainfall, making wine production the most significant local source of income by the end of the nineteenth century. Declining levels in the water table were first recognized as a significant problem during the first decades of the twentieth century when the Spring Valley Water Company began exporting significant amounts of water from Pleasanton area well-fields to urban consumers in San Francisco. Concerns about water scarcity prompted the formation of the Pleasanton Township County Water District, a precursor to what later became the ACFCWCD Special Act District, and water exports outside the Valley were banned starting in 1949.[248]

While the Post World War II population boom fueled rapid urban expansion across much of the San Francisco Bay Area, the Livermore-Amador Valley initially remained more rural and sparsely populated than many adjacent portions of Alameda County. With a population of just 6,600 in 1950 (compared with over 200,000 today), the Valley started the second half of the twentieth century with perennial overdraft of its groundwater resources coupled with poor drainage and high flood vulnerability. Valley voters rejected a 1954 proposal for a county-wide flood control and water conservation district, clamoring instead for greater local control over the Valley's groundwater resources. The next year the state legislature approved the creation of a locally run zone within the County Flood Control District—at a point in time when the Livermore-Amador Valley and adjacent highlands comprised only 4 percent of Alameda County's population but covered more than half of the land area within Alameda County. After gaining statutory approval from the legislature for the creation of a locally operated flood control and water conservation district, Livermore-Amador Valley voters approved the creation of an independent Special District on June 18, 1957. The District was to be supported by local property taxes and governed by a locally elected, seven-member Board of Directors, but with County Flood Control staff continuing to provide additional administrative and technical services.[249]

## Dates

**Creation of the Special District:** 1957
**Revisions or Amendments:**
1978 – Zone 7's Board of Directors is given greater local autonomy over flood control measures. Zone 7 relocates its staff to office space in Livermore (in 1987 moved to Pleasanton), rendering administrative and technical services related to flood control independent from centralized county-wide oversight.[250]
**Other Significant Dates:**
2005 – AB 1125 is approved by the State Legislature, modifying the ACFCWCD Act to grant Zone 7 Board autonomy over any and all projects of specific interest only in the Zone 7 service area – the District consolidates its engineering, administrative, and flood control staff into a single facility located in Livermore.[251]

## Special District Summary

Rapid population growth, urbanization and the delivery of State Water Project (SWP) water are the most significant factors in understanding how Zone 7 has evolved over time. One of Zone 7's earliest milestones as a newly created District was voter approval of a $5.76 million bond measure to finance initial flood control, water supply, and conservation improvements to be carried out in tandem with the construction of SWP aqueducts. Starting in 1962, initial South Bay Aqueduct deliveries from the SWP were used for groundwater recharge of the Livermore Groundwater Basin. Over the following two years, water supply from the South Bay Aqueduct was expanded to provide municipal water deliveries from Zone 7 to retailers, including the California Water Services Company in Livermore and the Valley Community Services District in Dublin.[252] These deliveries reduced local reliance on groundwater resources and provided sufficient municipal water supply for subsequent waves of (sub)urban development across the Livermore Valley.

By the early 1970s, the Valley's population exceeded 70,000 for the first time, a more than ten-fold increase in less than 20 years. Maintaining a philosophy that new development should pay for water system expansion, Zone 7 adopted hook-up and flood control fees for new homes, using the revenues to fund further water storage, water conveyance, water treatment and water quality infrastructure.

Zone 7's water supplies currently come from contracts and water rights, including imported surface water and local water runoff, and accumulated banked water supplies in storage. Using imported SWP water as the primary source of supply, Zone 7 emphasizes increasing groundwater storage, making it one of the few Districts in California to use its groundwater primarily as a drought reserve. This enabled it to cope with the drought of the late 1970s without resorting to water rationing.[253] Increasing groundwater storage capacity continues to remain a central focus, including the gradual conversion of former limestone quarries across the Valley into a series of artificial recharge lakes.[254]

Additional emphasis on water conservation began in the 1990s, with cash rebates offered for installing low-flow toilets, showers, and appliances starting in 1992. Throughout the 1990s and into the twenty-first century, Zone 7 staff continued to emphasize programs to use development fees to pay for water system expansion while also supporting environmental protection and sustainability.[255] Stream management plans for the watershed, and salt and nutrient management plans for the groundwater basin aimed to reduce levels of non-point source pollution, while providing incentives for habitat restoration. At the same time, enlargement of the South Bay Aqueduct increased the conveyance capacity to import SWP water into the Valley, enabling ongoing groundwater recharge in most years and providing capacity for future growth. Currently untreated SWP water is used for irrigation and treated SWP water is primarily sold to retailers who then sell that water to residents.

## Water Users

The profile of water users has shifted significantly since Zone 7's inception in 1957 with municipal demand playing an increasingly significant role in the wake of rapid suburban development across the Livermore-Amador Valley. The Valley's population increased more than 35-fold since voter approval of Zone 7 in 1957, while agriculture declined steadily in its contribution to the region's economy.[256]

Zone 7 imports treated SWP water that it sells to the four retailers, including Cities of Pleasanton and Livermore, California Water Service, and Dublin San Ramon Services District, who then deliver the water to local consumers. The retailers also pump groundwater but have a fixed annual quota. If they exceed the quota they have to pay a recharge fee. If they do not use their full quota they have a two-year period to carry it over. Zone 7 pumps some water as well, and individuals outside of city limits pump from their own wells. Zone 7 provides untreated SWP to agriculture and golf course irrigators. Currently municipal water use constitutes the overwhelming proportion of total water demand, as illustrated in Table 15.

**Table 15: Water Use 2013–2015[257]**

| Water Use | 2013 | 2014 | 2015 |
|---|---|---|---|
| Municipal | 41,500 AF<br>71% | 28,800 AF<br>79% | 24,600 AF<br>51% |
| Groundwater Recharge | 9,000 AF<br>15 % | 1,400 AF<br>4% | 3,900 AF<br>8 % |
| Untreated Irrigation | 6,200 AF<br>11% | 5,000 AF<br>14 % | 5,600 AF<br>12 % |

% = of total demand; numbers are rounded off

In addition to providing water to the retailers, Zone 7 also supplies untreated water for agricultural use to 3,500 acres, primarily vineyards in the southern portion of the Livermore Valley, but also for olives, pistachios, and prime beef.[258]

## Management Structure

Registered voters living within Zone 7's service area Zone 7 directly elect their seven-member Board of Directors.[259] Board members serve four-year terms and represent the Valley as a whole, rather than belonging to a specific district within the Zone 7 service area. The Board members' terms are staggered, with four terms expiring in one even-numbered year, and the remaining three terms expiring the following even-numbered year, followed by two subsequent years with no Board elections.[260] Any registered voter over the age of 18 living within Zone 7 service boundaries may run for election to the Board of Directors. There are no restrictions on term limits, with some Board members serving multiple consecutive terms.

Board members participate in one or more three-member board committees who review matters in greater depth before making recommendations to the Board as a whole. Currently the four Board Committees are: (1) the Administrative Committee, which reviews major facility needs, safety, and security measures and oversees independent district studies; (2) the Liaison Committee, which discusses topics of mutual interest between Zone 7, the cities, and retail water agencies, including rate change issues; (3) the Finance Committee, which reviews budgets, proposed financial plans, proposed rate changes, and connection charge changes; and (4) the Water Resources Committee, which addresses both flood control and water protection matters.[261]

## Management Strategies

Most of Zone 7's current groundwater management strategies are outlined in detail in the 2005 Groundwater Management Plan (GMP) (and Salt and Nutrient Management Plan incorporated into the GMP via reference). The GMP compiled and documented all of Zone 7's current groundwater management strategies and programs into a single document to reduce redundancies and areas of overlap, and to comply with state law.[262] Subsequent annual reports detail the level of success with which Zone 7 has accomplished the goals established in the 2005 GMP. The primary groundwater Basin Management Objectives (BMOs) established in the 2005 GMP provide for the control and conservation of water for future beneficial uses, the conjunctive use of groundwater and surface water, the importation of additional surface water to meet local demand, and the use of the groundwater basin to store imported surface water that would be used during drought periods.[263] To achieve these goals, Zone 7 has established a number of BMOs, which are detailed in the paragraph that follows.

The primary BMOs implemented by Zone 7 include:

- **Monitoring and maintenance of groundwater levels through conjunctive use and management of regional water supplies:** This BMO entails a number of sub-components, including maintaining balance between natural and artificial recharge and withdrawal, storing surface water supplies in the groundwater basin for use during times of drought, maintaining sufficient water levels to allow for emergency reserves during times of drought, preventing overdraft that would otherwise occur from too much pumping, and optimizing groundwater levels to allow for gravel mining without also threatening adequate municipal supply.

- **Monitoring and managing groundwater quality:** This entails a number of sub-strategies including halting degradation from salt build-up, reducing the flow of poor-quality shallow groundwater into the deeper aquifers, ensuring recharge occurs with low-TDS water, offsetting the impacts of water recycling and wastewater disposal through the Salt and Nutrient Management Plans developed in conjunction with the Regional Water Quality Control Board, and coordinating with both regional agencies and local water retailers to reduce the threat of contaminants entering groundwater aquifers.

- **Monitoring and preventing inelastic land subsidence from occurring as a result of overdraft:** Strategies to achieve this BMO entail: maintaining water levels in excess of historic lows; minimizing the impacts of gravel mining on the UAZ through the implementation of mitigation measures; shifting pumping to other wells in cases where water levels approach historic lows and/or land subsidence is detected; and protecting the overall storage capacity of the aquifers underneath Zone 7.

- **Monitoring and managing changes in surface flow and surface quality as they affect groundwater levels and groundwater quality:** Strategies to accomplish this BMO include: augmenting stream flow through artificial recharge releases to improve groundwater supply and quality and monitoring and protecting the recharge capacities of local arroyos.[264]

Additional programs and polices include: identification of wellhead protection areas across the Basin, regulations on the migration of contaminated groundwater, and Zone 7 well ordinances governing the construction and permitting of new wells.[265]

As part of their conjunctive use strategies, Zone 7 utilizes water transfers with the California Department of Water Resources (DWR) and Byron Bethany Water District, as well as with the Semitropic Water Storage District and Kern Water Bank. Significant cutbacks in the availability of imported SWP water during the current drought prompted Zone 7 officials to rely more heavily on these stored groundwater reserves. Zone 7 also instituted curtailments in municipal water use.

## Monitoring and Reporting

Because most of the water supplied by Zone 7 is for municipal use, most water quality monitoring and reporting in the Basin is conducted by public water agencies. Private groundwater production, which consists mostly of untreated water for irrigation, has averaged little more than 10 percent of total demand over the past five years.[266] Nonetheless, Zone 7 maintains a variety of ordinances and regulations on registration and monitoring requirements for privately operated wells.

Zone 7 first began collecting and maintaining well inventory information starting in the mid-1970s and has required drilling permits for all new wells since 1973.[267] Currently, permits and restrictions apply to any well construction, alteration, or destruction, and are subject to restrictions based on geographic location and potential threats from contaminants. New well construction has been very limited in recent years, with most new development taking place in suburban areas with access to municipal water supply. Regulations that have been in place since the 1980s have placed comprehensive restrictions on the construction of new residential septic tanks, with nearly all new residential and commercial development in the past couple decades taking place in areas served by municipal water supply and wastewater systems.[268]

Zone 7 has compiled a comprehensive database of historical groundwater elevation levels dating back to the first decade of the twentieth century, and has collected water quality records dating back to the pre-World War II era.[269] Zone 7 currently monitors more than 225 wells in the Main Basin to track monthly basin levels, groundwater basin seasonal extremes, groundwater basin quality, geologic evaluation, and water rights. Monthly measurements are regularly collected from approximately 80 of these wells, while all 225 wells are subject to semi-annual monitoring.[270] Zone 7 regularly tests for all water quality parameters mandated by state and federal law, and has expanded its testing of nutrient pollution above and beyond legally mandated minimums through the development of its recent Nutrient Monitoring Program.[271]

## Safe Yield

Long-term natural sustainable yield is contractually defined as the average amount of groundwater annually replenished by natural recharge in the Main Basin—through percolation of rainfall, natural stream flow, and irrigation waters, and inflow of subsurface waters—and which can therefore be pumped without lowering the long-term average groundwater volume in storage. "Artificial recharge" is the aquifer replenishment that occurs from artificially induced or enhanced stream flow, and it allows for more groundwater to be extracted from the Main Basin each year. The natural sustainable yield of the Main Basin (Figure 10) was determined to be about 13,400 AFY, which is about 11 percent of the operational storage. This long-term natural sustainable yield is based on over a century of hydrologic records and projections of future recharge conditions.[272] Figure 11 shows the natural sustainable yield demand components.

**Figure 10: Natural Sustainable Yield Supply Components[273]**

| SUPPLY COMPONENT | 2014 WY (AF) | SUSTAINABLE AVERAGE (AFY) |
|---|---|---|
| Natural Stream Recharge | 1,059 | 5,700 |
| Arroyo Valley Prior Rights | 0 | 900 |
| Rainfall Recharge | 1,169 | 4,300 |
| Applied (Irrigation) Water Recharge | 1,969 | 1,600 |
| Subsurface Groundwater Flow | 1,000 | 900 |
| *Subsurface Inflow* | *1,000* | *1,000* |
| *Basin Overflow* | *0* | *-100* |
| **TOTAL** | **6,098** | **13,400** |

**Figure 11: Natural Sustainable Yield Demand Components**

| DEMAND COMPONENT | 2014 WY (AF) | SUSTAINABLE AVERAGE (AFY) |
|---|---|---|
| Municipal pumping by Retailers | 7,456 | 7,214 |
| *City of Pleasanton* | *3,740* | *3,500* |
| *Cal Water Service* | *3,085* | *3,069* |
| *DSRSD* | *645* | *645* |
| Other groundwater pumping | 1,055 | 1,186 |
| Agricultural pumping | 636 | 400 |
| Mining Area Losses | 5,198 | 4,600 |

For most of the District's existence, Zone 7 artificially recharged the Basin with additional and imported surface water supplies by releasing water into the Arroyo Mocho and Arroyo Valley. The existing artificial recharge capacity of the arroyos typically ranges from 12,300 to 20,000 AFY, but this capacity was not utilized during 2012–2014 due to unavailability of surface water supplies in the 2012–2014 drought. Adding artificial recharge essentially doubles the natural recharge of the Basin and has allowed Zone 7 to build up additional groundwater storage reserves for times of drought.[274]

The proposed Chain of Lakes Recharge project is expected to further augment the capacity for artificial groundwater recharge by converting former mining quarries into a series of artificial lakes. Demineralized recycled water could potentially be stored in the Chain of Lakes and further diversions could allow surplus water to be used to recharge the groundwater basin. The first two converted mining pits, now Cope Lake and Lake-I, became available in 2003, and plans for a total of nine artificial lakes expect to be to be completed around 2058.[275] Specific figures of precisely how much these lakes will increase the potential for groundwater recharge are not currently available, but, when complete, the rate of artificial recharge is expected to far outstrip natural recharge. In addition to the groundwater recharge capacity, the Lakes will provide additional local storage capacity.

## Groundwater Pumping and Overdraft

Reliance on imported water from the SWP has allowed Zone 7 to halt and reverse groundwater overdraft over most of the past five decades. Prior to the 1960s, groundwater was the only available source to meet both municipal and agriculture irrigation needs, and groundwater overdraft was a significant concern until the arrival of imported SWP water in the 1960s. Since the 1960s, groundwater levels across the Livermore Basin have risen overall, with the exception of a period of decline during the droughts of the late 1970s, late1980s/early 1990s, and the 2012–2015 drought.

Today groundwater pumping by Zone 7 comprises only a fraction of total District demand.[276] It comprised 9,800 AF of the 58,100 AF total in 2013 and 7,600 AF of the 36,100 AF total in 2014, amounting to about 20 percent of total District demand. In precipitation years that come close to historical averages, Zone 7 groundwater production amounts to less than 20 percent of total water production; whereas in dry years this figure sometimes exceeds 20 percent. In addition, the four retailer agencies pump about 7,200 AFY. Groundwater pumping by individual well owners for domestic and agriculture uses and other entities in the Valley is about 1,000 AFY. Evaporation from gravel mining ponds and gravel mining use is about 5,000 AFY.[277]

By importing approximately 75 percent of the Valley's water supply (delivered to Zone 7's retailers and agricultural customers) and recharging the Main Basin with surplus surface water when available, Zone 7 is able to minimize groundwater depletion. The surface water supplies come from the following entities:

- State Water Project
- Arroyo Valle Water Rights (Lake Del Valle)
- Byron Bethany Irrigation District, Kern Groundwater Basin (storage rights in the Semitropic Water Storage District and the Cawelo Water Storage District – used to remotely store surplus SWP water when available)
- The Yuba Accord
- DWR's Multi-Yield Pool
- The State Water Contractors Dry Year Transfer Program

Available non-storage water in 2014 was primarily from the SWP.

Zone 7 has artificially recharged over 51,000 AF more water than it has pumped, enabling the Main Basin's water levels to mostly stay above historical lows. Zone 7's groundwater extraction for its treated water system does not use the natural sustainable yield from the Main Basin; instead, Zone 7 pumps only water that has been recharged as part of its artificial recharge program using its surface water supplies. During high demands, groundwater is used to supplement surface water supply. It is also used when the South Bay Aqueduct (SBA)[278] is out of service, when Zone 7's surface water treatment plants are operating under reduced capacity or during drought conditions, when there may be insufficient surface water supply available. Zone 7 also pumps groundwater out of the Main Basin during normal water years to help reduce the salt loading in the Main Basin.[279]

Water in storage now far exceeds total annual demand, with a total year-end storage of 207,600 AF at the end of 2013, and a total year-end storage of 173,700 AF at the end of 2014. Of the 173,700 AF of water storage at the end of 2014, 70,000 AF were stored in the Livermore Groundwater Basin, while the remaining stored water consisted of surface water resources, reservoirs, and off-site sources of water banking.[280]

As noted, Zone 7 remains heavily dependent on Sierra snowmelt to meet its annual water needs, with more than 80 percent of total water demand over the past five years met with imported water.[281] Moreover, sharp curtailments in the availability of SWP water in 2014 saw an increased need to fall back on reserves stored in the groundwater basin. Despite this, however, groundwater levels remain substantially higher than during their historic lows in the early 1960s.

## Water Quality

Other than localized contamination from toxic sites, the main constituents of concern for meeting groundwater quality objectives in the Livermore Groundwater Basin are total dissolved solids (TDS) and nitrates in certain areas of the groundwater basin. Although not specifically included in state-mandated reporting requirements, naturally occurring boron also poses a potential concern in certain aquifers of the Main Basin.

Over the past 40 years there has been a general upward trend in TDS concentrations in the western portion of the Main Basin, while the eastern and central portions of the Main Basin, the very same areas with the highest rates of artificial recharge, have seen consistently low concentrations of TDS. Potential reasons why the western portion of the aquifer sees higher rates of TDS include the concentrating effects of urban irrigation, the leaching of buried lacustrine sediments, and historical wastewater and sludge disposal practices.[282] Nitrate is detected at levels exceeding the Basin Objective (BO) set forth by the Regional Water Quality Control Board in a few locations in the Upper Aquifer System (UAS). There is a plume of high nitrate concentrations that extends from the western portion of the Mocho I Sub-basin to the northeastern portion of the Amador Sub-Basin. Additional areas of high nitrate concentration include a couple monitoring wells in the far southern portions of the Mocho I and Mocho II Sub-basins and in the May Sub-basin near May School Road.[283] However, nitrate levels are below recommended thresholds at the overwhelming majority of monitoring wells across the Main Basin. The nitrate loading and assimilative capacity is currently being studied as part of the Salt Management Plan amendment.[284]

## Disputes

A ban on the export of local water passed in 1949. This led to many contentious water rights disputes in eastern Alameda County that were settled before the 1957 creation of Zone 7.[285] During the first half of the twentieth century there were numerous water rights lawsuits filed over who had rights to extract and benefit from Livermore Basin Groundwater. Rapid urbanization and the importation of SWP water defined much of Zone 7's early years. In 2000, a lawsuit filed by Zone 7 and the City of Pleasanton challenged whether the Dublin San Ramon Service District had the right to inject highly treated wastewater back into the Livermore Groundwater Basin.[286] In 2002, the court ruled in favor of Zone 7 and the City of Pleasanton on procedural grounds, directing the Regional Water Quality Control Board to hold a public hearing on the issue and decide the matter by a vote of the entire nine-member Board. This halted the injection of treated wastewater back into the groundwater basin.

## Discussion

Zone 7 has been highly effective in reversing groundwater overdraft and recharging the Livermore Groundwater Basin through artificial recharge techniques, increased water storage capacity, and a reliance on imported water. While the first few decades of Zone 7's existence saw an emphasis primarily on increasing water supply and storage capacity, sustainable groundwater management has been a central tenant of Zone 7's stated policies since at least 1987 when it passed a resolution calling for the sustainable management of the Basin's groundwater resources.[287]

In more recent years, Zone 7 staff increased its emphasis on conservation efforts, and achieved some of the largest annual demand reductions of any water management district in the state during the 2012–2015 drought.[288] Recent projects and policies also emphasized conjunctive management strategies, and new nutrient and salt management programs were implemented over the past decade.

Currently, there exists nearly two years' worth of annual demand in storage in the Livermore Groundwater Basin, and nearly three years' worth of annual demand in reservoirs, surface water resources, and other off-site storage facilities.[289] Groundwater recharge rates have declined somewhat during the two years of the 2013–2015 drought, but are still in excess of what they were at the time of Zone 7's founding. Land subsidence has not been a significant problem since the arrival of SWP water in the 1960s, but continued groundwater recharge remains very reliant on imported water resources.

## Analysis

- Efforts to balance groundwater withdrawals with groundwater recharge were a feature of Zone 7's groundwater management strategies since it first started importing SWP water in the 1960s. Groundwater levels across the Livermore Basin are higher today than they were for much of the twentieth century, thanks to artificial recharge efforts, enhanced water storage capacity, and a reliance on imported water to meet municipal demand. In 1987 "sustainable groundwater management" became a key part of District planning documents. Nearly all annual reports and publications since then have emphasized the need to promote and protect sustainable groundwater resources. Today, Zone 7 has some of the most ambitious conservation and rationing programs in effect in California.

- The Zone 7 service area has undergone significant population growth, (sub)urbanization, and major economic and demographic shifts since its inception in 1957. While irrigation for agriculture was once a significant component of Zone 7's water use, today agricultural production plays a relatively marginal role compared to many other Districts in the state. Among the current Board of Directors, only one of the seven members has any ties to agriculture at all, while four of the seven have significant training and/or experience in the environmental sciences.

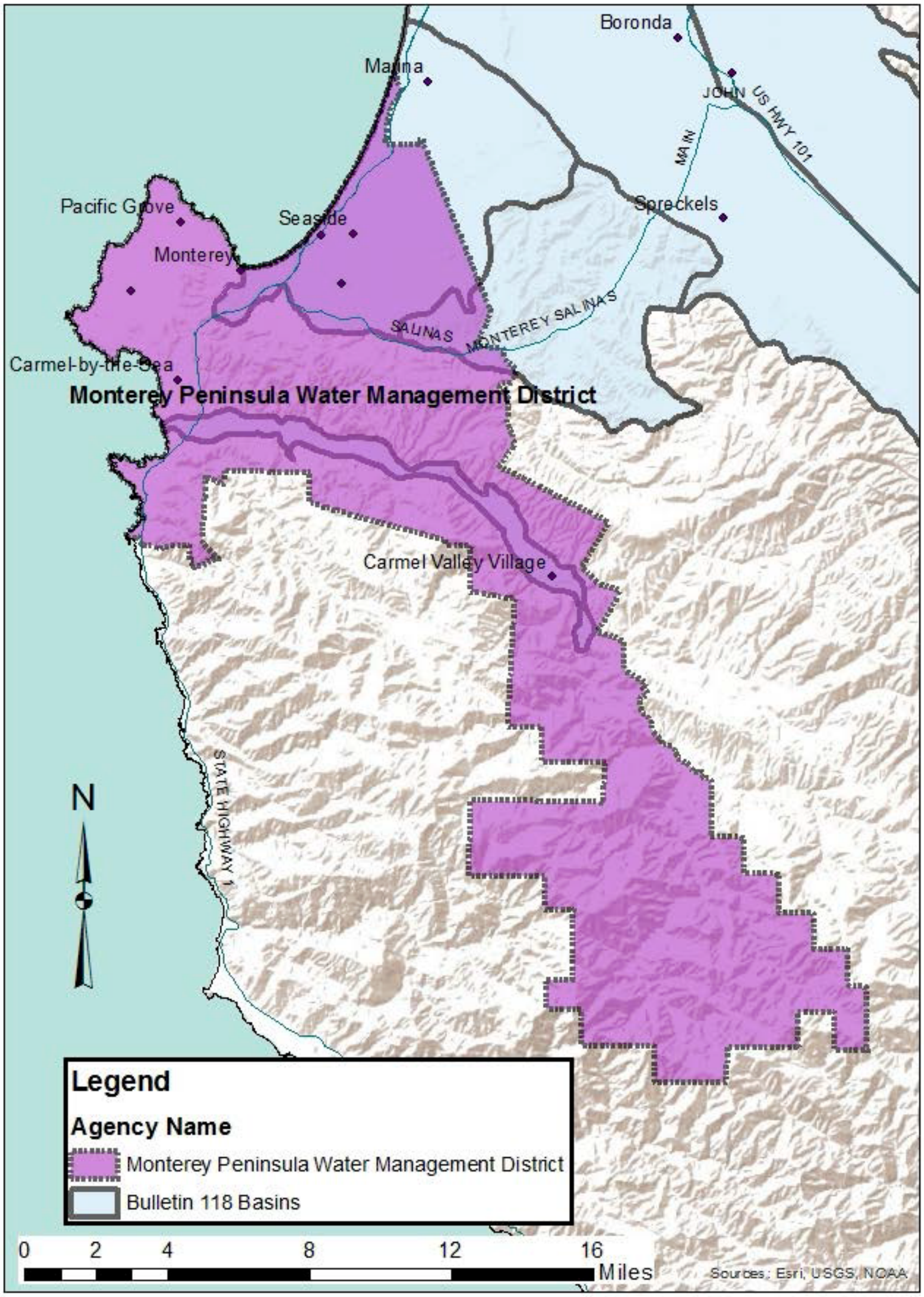
- Like many other Special Districts in the state, it would be difficult for Zone 7 to meet local demand with only local ground and surface water resources. Currently, about 80 percent of demand is met using imported water, and while there are aggressive efforts to increase recharge capacity and increase local supplies such as recycled water that could bring this figure down in future years, the ACWD will likely remain reliant on imported water to meet local demand for some time. Given that most of the imported water originates from Sierra snowmelt, climate change impacts could play a significant role in reducing the future availability of imported water through existing SWP infrastructure. Though Zone 7 is already able to recharge its groundwater basin using less than its contracted amount of SWP water, the effects of a longer-term drought could have more serious impacts on the Livermore Groundwater Basin.

## Alameda County Flood Control and Conservation, Zone 7 (Zone 7)

| Funding | Enabling Legislation |
|---|---|
| **1. General Fund:** Property Tax<br>**2. State Water Facilities Fund:** Property Tax Override<br>**3. Water Facilities Fund:** Water Sales<br>**4. General Obligation Bond Fund:** Bond Sales<br>**5. Flood Protection and Stormwater Drainage Development Impact Fee Fund:** Drainage Fees<br>**6. Water Enterprise/Reclamation Trust Fund:** Tonnage/Recharge Fees<br>**7. Vehicle Acquisition Fund:** Mileage Fees<br>**8. Water Enterprise Expansion Fund:** Connection Fees<br>**9/10.Water Enterprise Improv/Replacement Funds:** Water Sales | **Regulate pumping: Municipal:** Yes; **Other:** No<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body elected by all the voters or just property owners:** At-large Board of Directors elected by all registered voters living within the service area. |

| Safe Yield | Extractions | Trends | Accumulated Overdraft |
|---|---|---|---|
| Natural Recharge (10,000 AFY in median precipitation year; lower in times of drought)<br><br>Artificial Recharge (10,900 AFY)[290]<br><br>Additional 7,400 AFY of artificial recharge realized through new "Chain of Lakes" project that went online in 2014.[291] | 9,800 AFY (2013 rate of direct extraction from the aquifer by Zone 7)<br><br>7,600 AFY (2014 rate of direct extraction from the aquifer by Zone 7)<br><br>58,100 AF (Districtwide demand in 2013 – mostly met through sources other than groundwater)<br><br>47,900 AF (Districtwide demand in 2015 – mostly met through sources other than groundwater)[292] | Since the 1960s, groundwater levels across the Livermore Basin have risen overall, with the exception of a period of decline during the droughts of the late 1970s, late1980s/early 1990s, and the 2012–2015 drought.<br><br>Note that most demand is met from sources other than groundwater. | Groundwater levels in the Livermore-Amador Basin are substantially higher today than they were a generation ago.<br><br>198,000 AF was available in storage at the end of 2014, substantially higher than historic lows of 128,000 AF in storage in the 1960s, but below a peak of 254,000 AF storage found in the early1980s. |

# Monterey Peninsula Water Management District



# Monterey Peninsula Water Management District

## Overview

| | |
|---|---|
| **County** | Monterey |
| **Area** | Seaside: 40.5 sq mi; Carmel Valley: 8 sq mi;[293] total area covered by the Monterey Peninsula Water District (MPWMD) is 170 sq mi[294] |
| **Population (2010)** | Within Seaside Area: 65,899; within Carmel Valley: 5,086;[295] within MPWMD boundaries: 104,129[296] |
| **CASGEM** | Medium (Seaside) and High (Carmel Valley) |

CASGEM = California Statewide Groundwater Elevation Monitoring

The service area of Monterey Peninsula Water Management District (MPWMD) includes portions of the Carmel Valley basin and the Seaside Area sub-basin of the Salinas Valley groundwater basin.

Carmel Valley is a small basin including water-bearing deposits that are hydraulically connected with the Carmel River. Average precipitation in the area is 17–19 inches per year. An estimated 85 percent of the aquifer's recharge comes from the Carmel River, and groundwater levels rapidly recover in the presence of surface water. Estimates of the aquifer's total storage capacity range from 48,200 to 60,000 acre-feet (AF).[297] The river has an annual runoff of 67,400 acre-feet per year (AFY).[298] Current extractions from its associated alluvial aquifer accounts for approximately 70 percent of domestic water supply in the MPWMD area.[299] In 1995, the State Water Resources Control Board (SWRCB) ruled that downstream of river mile 15, the aquifer close to the river is a subterranean stream, and as such SWRCB holds permitting authority.[300]

The Seaside Area basin lies beneath a coastal plain within the Salinas Valley and extends westward beneath Monterey Bay. It is divided into three aquifers: the deepest is the Santa Margarita, then Paso Robles, and the Dune Sands aquifer is the shallowest. The Santa Margarita and Paso Robles aquifers are primarily used for production.[301] The basin's total storage is estimated at 1 million AF. Recharge occurs from deep percolation from rainfall and irrigation flows, septic systems, and possibly minor amounts from streams.[302] The service area of the MPWMD includes six cities, which account for the majority of water use in the district. In addition, the region contains unique and scenic natural areas, and tourism and recreation are important elements of the region's economy.

## Background to District Formation

MPWMD was established through the Monterey Peninsula Water Management Act (Assembly Bill 1329, 1977; California Water Code Appendix 118), and was approved by voters in 1978. It was created in the wake of the 1976–1977 drought, which highlighted serious water supply constraints on the Monterey Peninsula. The legislature recognized the need for an agency with authority to manage water supplies in an integrated manner, including ground and surface water resources, particularly in light of the region's scenic qualities, which could be threatened by environmental degradation.[303] The boundary of the District includes the California-American Water Company's (Cal-Am) Monterey District, which serves 95 percent of the region's potable water users, and also includes the majority of the Carmel River Watershed and the Seaside groundwater basin.[304]

## Dates

**Creation of the Special District:** 1977 (voter approval in 1978)
**Revisions or amendments:** None
**Other:**
1995 – The State Water Resources Control Board (SWRCB) orders reduced pumping from the Carmel Valley aquifer, leading to increased pumping in the Seaside basin
1996–1997 – California red-legged frog and Carmel River steelhead listed as threatened species under the Endangered Species Act (ESA)
2006 – Adjudication of the Seaside Basin
2009 – Second order by the SWRCB to reduce pumping from the Carmel Valley system

## Special District Summary

The MPWMD serves approximately 112,000 people within the cities of Carmel-by-the-Sea, Del Rey Oaks, Monterey, Pacific Grove, Seaside, Sand City, the Monterey Peninsula Airport District, and portions of unincorporated Monterey County, including Pebble Beach, Carmel Highlands, and Carmel Valley. In 2015, the estimated population for the entire Monterey County was 433,888.[305] Median household income in Monterey County as of 2008 was $58,822 compared to a national average of $52,029. But there were differences between the communities of Pebble Beach and the City of Carmel, with house prices over $1,000,000, and Seaside, with the average house price at $280,000.[306]

In the 1977 enabling legislation, MPWMD was granted significant authority over multiple aspects of water management within its service area. The four key elements of its mission are: (1) integrated management of ground and surface water sources; (2) water conservation, including rationing if required; (3) water reuse and reclamation; and (4) protecting environmental quality, fish and wildlife in the Monterey Peninsula and Carmel River Basin. The agency manages surface water supplies from the Carmel River, which are stored in the Los Padres Reservoir, and groundwater from the Carmel Valley and Seaside Area groundwater basins. MPWMD has jurisdiction over Cal-Am's operations within its boundaries, including setting ground and surface water production levels, and setting water use fees to enable it to carry out management activities to achieve its goals. It also runs water metering programs for all wells within its region, monitors surface and groundwater levels, determines release rates from the reservoir to meet instream flow requirements, implements water conservation programs and rationing during droughts, and conducts watershed management and restoration activities in the Carmel River Watershed. It also holds the authority to approve new or expanded water distribution systems, including changes to private wells.[307]

While MPWMD's authority includes management of groundwater in the Seaside Basin, its jurisdiction is not exclusive over this basin. In 1990, the state legislature established the Monterey County Water Resources Agency (formerly the Monterey County Flood Control and Water Conservation District). Its powers also include management of groundwater, in cooperation with MPWMD. In the early 2000s, MPWMD began the process of preparing a Groundwater Management Plan for the Seaside basin. However, the 2006 adjudication of the Seaside Basin superseded these efforts. Further, as part of the adjudication judgment, the court established a collaborative Watermaster, composed of 13 voting positions held among nine representative parties, with MPWMD having two voting positions.[308] MPWMD filed a complaint asserting that it should serve as the Watermaster given its established mandate over groundwater. However, the court ruled that the legislature did not intend for MPMWD's authority to be exclusive, and that the court's adjudication takes precedence.[309]

In 2008, Cal-Am applied to the MPWMD for a permit to allow Cal-Am to pump water from the Seaside Basin to serve a proposed eco-resort. MPWMD conducted hearings on the application and voted to deny the application until, pursuant to the California Environmental Quality Act (CEQA), a new environmental impact report (EIR) could be prepared that focused on the potential impacts of the project on the Carmel River, as well as on the Seaside Basin, and that included an evaluation of the project and possible alternatives. The court found that, although the MPWMD had authority to issue water distribution permits, it "cannot exercise that authority in contravention of the Physical Solution imposed by the Amended Decision for management of the Basin." Accordingly, the court ruled that "the Physical Solution governs the environmental aspects of Seaside Basin [groundwater] usage, and . . . no [p]arty to this adjudication can require environmental review under [CEQA] with regard to such usage. . .." The court went on to state that "clearly the [L]egislature contemplated that courts had the power to develop management plans for aquifer management even if a water management district already existed in a geographical area," and that Water Code section 10753 precluded any local agency's adoption and implementation of groundwater management plans to the extent that its service area is already managed by "a court order, judgment, or decree." Thus while acknowledging that MPWMD retained certain powers to regulate the Seaside Basin, the court stated it could only do so in a manner consistent with the 2007 adjudication judgment. Accordingly, the MPWMD will not be able in the future to adopt a groundwater management plan for the Seaside Basin.[310]

## Management Structure

A seven-member Board of Directors governs the MPWMD. Five members are elected. One is a member of the Board of Supervisors of Monterey County, and another member is selected to represent the cities within the District. Several Board committees focus on specific issues, including Carmel River management, Water Supply, Water Demand, Rules and Regulations, Legislative Advocacy, and Public Outreach, and these committees make recommendations to the Board.[311] MPWMD's 2014–2015 budget totaled approximately $11 million, and employs approximately 30 staff members. Its revenue sources include a water supply charge, charges to Cal-Am customers to mitigate damage to the Carmel River watershed, property taxes, grants, and permit revenues.[312]

## Water Users

Cal-Am is the primary water user in the two basins within MPWMD's boundaries, providing service to approximately 95 percent of the region's potable water users.[313] A 2015 estimate indicates that of the 14,300 AFY of water produced within MPWMD, approximately 10,000 AF is produced by Cal-Am. In addition, non Cal-Am pumpers with riparian water rights produce 2,200 to 2,400 AFY from the Carmel Valley Alluvial Aquifer.[314] In Seaside Basin, the cities of Seaside and Sand City, two real estate companies, two companies involved in construction and building materials, two golf courses, one cemetery, a school, and the County of Monterey (which extracts water for a county park) have been determined to have overlying or appropriative rights to water under the adjudication.[315] In the Carmel Valley basin, the primary water user is Cal-Am, but MPWMD has a joint permit with Cal-Am to divert water during the wet season for Seaside basin replenishment.[316]

## Management Strategies

MPWMD has undertaken several efforts in collaboration with Cal-Am in response to the restrictions on the use of Carmel and Seaside basins, which require Cal-Am to reduce its production from the Carmel River basin by 60 percent between 2009 and 2017, and by about the same percentage in the Seaside Basin between 2007 and 2021.[317] Since 2001, MPWMD has worked with Cal-Am to withdraw excess water during wet years from the Carmel River system and inject it into the Seaside Basin for storage and withdrawal by Cal-Am during dry years. Under this project, a total of 4,390 AF has been transferred from the Carmel River to the Seaside Basin through water year 2015.[318] MPMWD has also been developing the Seaside Basin Groundwater Replenishment Program in collaboration with the Monterey Regional Water Pollution Control Agency and Cal-Am. This project would use recycled water to replenish the basin, and would generate about 3,500 AFY for Cal-Am's use.[319] Cal-Am is also undertaking the Monterey Peninsula Water Supply Project, which includes the development of a desalination plant and an expansion of an Aquifer Storage and Recovery (ASR) project in cooperation with MPWMD as described above, which transfers excess water from the Carmel River to the Seaside Basin, and a project variant that includes the Groundwater Replenishment Project.

In 2015, MPWMD adopted strategic goals including the following:

1. **Continue to Advance Water Supply Projects,** including the Cal-Am desalination project, groundwater replenishment, and collaboration with jurisdictions to advance the development of local supplies.
2. **Develop Ordinance and Allocation Frameworks for Locally Developed Supplies,** including the reallocation of potable water saved by conversion to non-potable irrigation.
3. **Respond to New Sustainable Groundwater Management Act,** including adopting a resolution designating MPWMD as the Groundwater Sustainability Agency within its jurisdiction.
4. **Revise the Rationing Program,** to address needed reductions in water supply due to drought, climate, and the Seaside Basin adjudication.
5. **De-link the Residential and Commercial Sectors,** including a reevaluation of rationing categories and triggers and the baseline need for individual use.
6. **Establish a Short-Term Action Plan and Long-Term Strategy for Los Padres Dam.**
7. **Establish Clear Requirements for Water Distribution Systems within the District**[320]

## Monitoring and Reporting Requirements

MPWMD's Well Registration and Reporting Program requires well owners within its boundaries (including Seaside and Carmel Valley basins) to register and report data such as annual extractions for each well. Cal-Am reports well data on a monthly basis, while other producers report every six months or annually.[321] In Seaside Basin, MPWMD conducts monitoring on behalf of the Watermaster on groundwater quality and groundwater levels.

## Safe Yield

With respect to Seaside, a 2005 study conducted for MPWMD found that the safe yield for the basin was 2,880 AFY.[322] This report defined this as the "sustainable safe yield," or the average annual amount of water that could be withdrawn without experiencing "undesirable effects" such as seawater intrusion (of primary concern in this basin), subsidence, declining groundwater levels, or degradation of water quality.[323] In the adjudication proceedings for the Seaside basin, a "natural safe yield" was defined to mean "the quantity of groundwater existing in Seaside Basin that occurs solely as a result of natural replenishment," and was determined to be between 2,581–2,913 AFY.[324] In the 2006 decision, 3,000 AFY was used as the natural safe yield estimate, to which production from the basin must be lowered by 2021.[325] However, the court also defined an allowable "operating safe yield," set at 5,600 AFY for three years, after which it is to be reduced by 10 percent triennially.[326] In 2007, the SWRCB approved a permit for MPWMD and Cal-Am together to divert an additional 2,426 AFY during the wet season for the ASR project for Seaside Basin. Although not described as a "safe yield," a total of 5,742 AFY was established by SWRCB as the allowable withdrawals from the basin.[327]

## Groundwater Pumping and Overdraft

Prior to MPWMD's establishment, pumping from the Carmel Valley alluvial aquifer was occurring at the rate of approximately 5,900–9,100 AFY. In addition, direct diversions from the Carmel River for Cal-Am municipal use ranged from 2,700–9,100 AFY during the same 1974–1978 period. This posed sufficient stress on the basin that pumping restrictions were imposed during the 1977 drought.[328] Pumping continued to grow, and by 1995, Cal-Am was pumping approximately 14,000 AFY from the river and its associated groundwater basin, in excess of its established right. Cal-Am continued to divert excess water, resulting in the river running dry for 5–6 months each year.

The law in California states that surface water and subterranean stream water are within the permitting jurisdiction of the SWRCB and appropriation of those waters requires a SWRCB permit, and is subject to various permit conditions. Water in sediments underlying the Carmel River were ruled to be a subterranean stream, and therefore under SWRCB jurisdiction. In response, in 1995 the SWRCB ruled that Cal-Am was diverting in excess of its diversion right, and its pumping in excess of this amount was impacting public trust resources, in particular threatened steelhead fish populations and the endangered red-legged frog.

However after 1995, Cal-Am continued to pump heavily in the Seaside Basin. Water levels in the Santa Margarita aquifer declined from 5 feet above sea level to about 15 feet below sea level by 2008. Observations at one Cal-Am well showed that between 1960 and 2002, water levels dropped about 60 feet.[329] MPWMD's 2005 study found that pumping from Seaside was up to 5,600 AFY, almost twice the safe yield.[330] The 2006 adjudication determined that the basin was in overdraft, and that by 2021, groundwater pumping be reduced from the then average of 5,600 AF to a safe yield of 3,000 AFY, to avoid seawater intrusion.[331]

In 2009, SWRCB issued another order requiring Cal-Am to reduce its withdrawals incrementally so that it does not exceed its water right, and to reduce withdrawals by 70 percent between 2009 and 2016.[332] For the Carmel Valley Basin, SWRCB's 1995 and 2009 orders established limits on Cal-Am's and other appropriative rights for extractions from the Carmel River and its associated groundwater basin.

The SWRCB 2009 order combined with the 2006 adjudication mean that Cal-Am must reduce its withdrawals from both basins from a total of approximately 15,000 AF in 2009 to a firm yield of 4,850 AFY in 2021, not including withdrawals based on water rights subject to instream flow requirements in the Carmel River. Cal-Am additional water rights[333] and MPWMD rights for the ASR project total 6,914 AFY; however, these rights are subject to minimum instream flow requirements. MPWMD estimates that the long-term average of these latter rights may yield 2,280 AFY to 3,457 AFY.[334]

In April 2016, Cal-Am, MPWMD, and others amended an earlier 2015 petition to the SWRCB with a request to modify and extend the SWRCB order to December 31, 2021, in order to allow more time to complete replacement water supply projects.[335] In July 2016, the SWRCB approved Cal-Am's petition with modifications.[336]

## Water Quality

Seawater intrusion is a significant risk in the Seaside Basin. Although groundwater levels are still low, and pumping in excess of recharge continues, according the most recent Seaside Watermaster annual report, seawater intrusion has not yet occurred.[337] No significant water quality issues are apparent in the Carmel Valley basin.[338]

## Disputes

In general, as an agency charged with integrated water management, MPWMD coordinates multiple parties within its jurisdiction to develop and implement management strategies. It also collects and manages data about both groundwater basins and conducts studies that have contributed to an improved understanding of problems facing the basin. However, Cal-Am's initiation of the adjudication process suggests that disputes existed in the region. MPWMD opposed the approval of the stipulated judgment requested by Cal-Am, Seaside, Sand City, and others, and argued that it should be the Watermaster for the basin. The court rejected its argument, indicating that MPWMD did not have exclusive authority over management of the groundwater basin. In 2008–2009, MPWMD sought to exercise its authority to require environmental review of a proposed development to protect the groundwater supply, but Cal-Am and Sand City successfully challenged in court MPWMD's right to review (see above discussion). Thus, the courts have played a significant role in managing ongoing disputes over management of the basin.[339]

## Discussion

Although a crucial element of MPMWD's mandate is to manage groundwater in the Carmel Valley basin, SWRCB has played a significant role in establishing pumping limits that were in place since 1995. MPWMD worked closely with Cal-Am in complying with these orders. While SWRCB found that Cal-Am had not complied fully with reductions required in 1995, reports during MPWMD board meetings indicate that Cal-Am was complying with SWRCB's 2009 order to reduce pumping from the Carmel River system.[340] Since groundwater levels are closely linked with streamflow in the Carmel Valley, reduced pumping could result in groundwater levels recuperating during wet seasons more rapidly than they had been previously.

MPWMD has been undertaking restoration efforts to ensure the health of the watershed and protect wildlife habitat. For the Seaside Basin, there is evidence from one Cal-Am well that during the period of 1960–1975, prior to MPWMD's formation in 1977, groundwater levels were steadily declining.[341] While MPWMD developed monitoring systems and studied basin conditions, it does not appear that MPWMD undertook significant efforts to reduce groundwater overdraft until shortly before the adjudication process began, when it initiated the development of a Groundwater Management Plan for the basin. Since the 2006 judgment, MPWMD has been helping to implement the adjudication. The Watermaster's 2014 annual report indicates that overall, groundwater extractions during water year 2014 were below the operating safe yield agreed to under the adjudication, although Cal-Am's withdrawals exceeded its allocation.[342] However, the operating safe yield still exceeds the natural safe yield of 3,000 AFY.

## Analysis

1. MPWMD was established with broad authority to manage surface and groundwater resources in the Monterey Peninsula in an integrated manner. Its jurisdiction encompasses the Carmel River system and its associated Carmel Valley groundwater basin, as well as the Seaside basin. By operating at this scale, MPWMD has been able to oversee the operations of the region's major water supplier, Cal-Am, which draws water from both basins.

2. MPWMD's exclusive authority to manage these two basins has been challenged over the years. The Carmel Valley basin was ruled to be a subterranean stream, placing it under SWRCB's permitting authority. The Seaside Basin was adjudicated in 2006 after reductions ordered by SWRCB in the Carmel Valley basin led Cal-Am to shift its water production to Seaside Basin. A separate Watermaster has been established, in which MPWMD participates but shares authority with eight other entities represented on the Watermaster Board. Thus, pumping limits in both basins were established not by MPWMD, but by SWRCB and the courts.

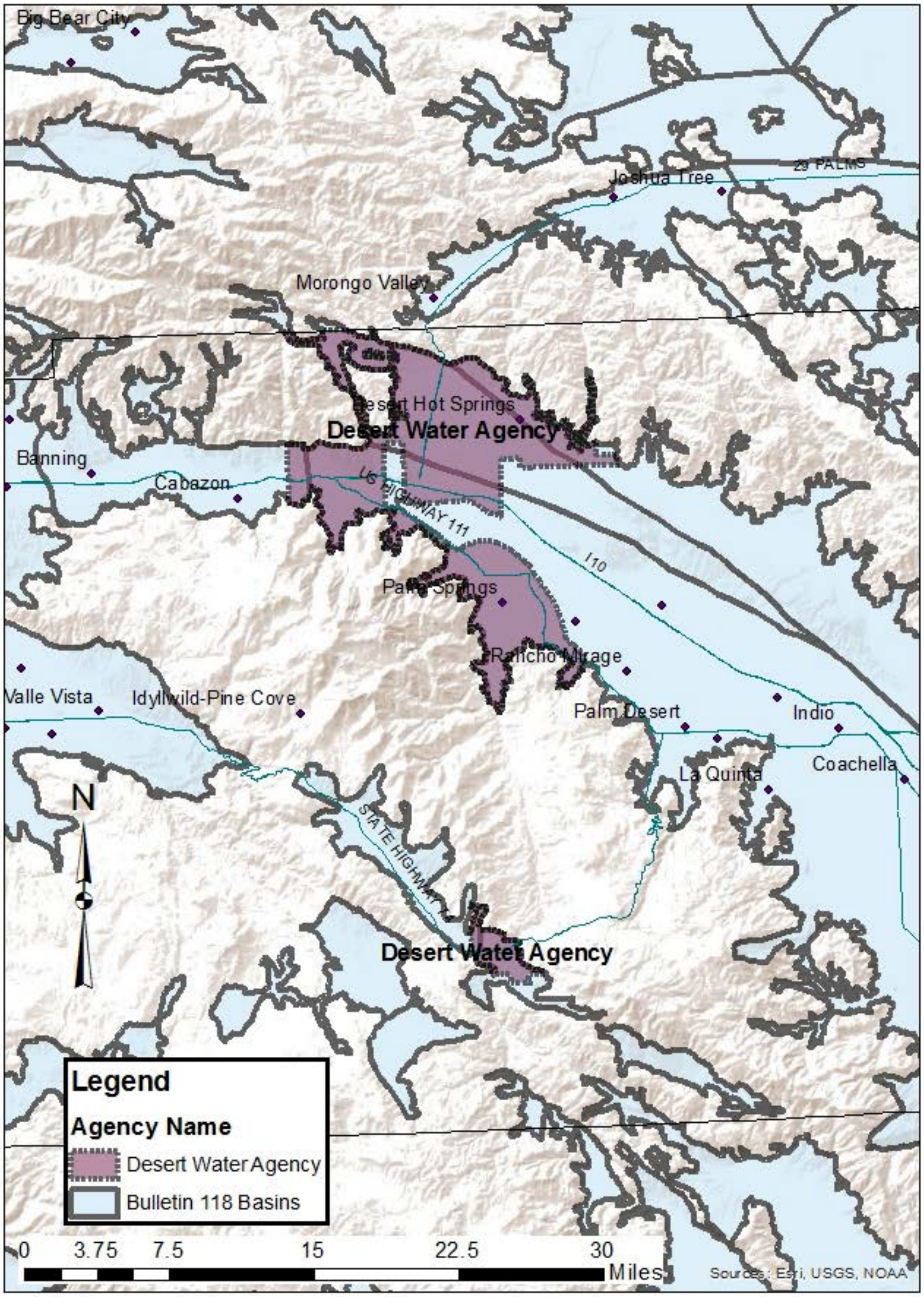
3. Recognition of the environmental uses of water in the Carmel Valley was an important driver leading to reductions in groundwater pumping. These reductions were made possible in part because SWRCB holds permitting authority, and ordered the reductions to protect public trust resources. In addition, National Marine Fisheries Service activities in the Carmel River to protect steelhead have strongly influenced the conditions under which SWRCB issues diversion permits and the water management practices in the basin.[343] MPWMD's mandate includes watershed management, and it undertakes significant habitat restoration activities.

4. Pumping reductions in both basins have forced Cal-Am to replace the majority of its water with new sources. Strategies are currently being explored to address this challenge, including increasing groundwater recharge, building a desalination plant, and promoting water conservation in order to meet new demand.

| Funding Mechanisms | Other Capabilities |
|---|---|
| **MPWMD is funded through a wide range of different revenue streams including:**<br>**1. Water Supply Charges** (the single greatest source of funding for the District).<br>**2. *Ad Valorem* Property Tax**<br>**3. Various Management Charges** (these include Mitigation Revenues, Permitting Fees, and Recording Fees)<br>**4. Project Reimbursement:** MPWMD is reimbursed by Cal-Am water company for costs associated with conservation, rebates, ASR 1, and ASR 2. | **Regulate pumping:** Yes<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body:** Hybrid Board of Directors comprised of **five elected members, and two appointees** representing existing political entities within MPWMD service area.<br><br>MPWMD has wide-ranging statutory authority to do "any and every lawful act necessary" to ensure sufficient water supply for beneficial uses within District service area.[344]<br>See California Water Code, Appendix Chapter 118-1 to 118-901. |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
|---|---|---|---|---|
| 2006 natural recharge: ~2,581–2913 AFY (Seaside Groundwater Basin adjudication)<br><br>Adjudication definitions:<br>2006 safe yield - 3,000 AFY<br>Temporary "operating safe yield" (OSY) 5,600 AFY for 3 years before declining by 10% triennially until eventually reaching the 3,000 AFY no later than 2021.<br><br>2015 water year: 12,244 AF of water legally available from Seaside Basin groundwater and the Carmel River, over which SWRCB has permitting and regulatory authority. | Late 1900s/early 2000s: pumping = ~ 14,000 AFY.<br>WY 2015 Cal-Am production = 10,024 AF, but Cal-Am Seaside Basin pumping = 2,765 AF and is currently in excess of OSY (2,299 AF);<br>WY 2015 Watermaster Producers production = 3,762 AF, but court ordered to reduce pumping to the rate of 3,000 AFY by 2021.<br><br>Cal-Am was mandated to reduce its extractions by nearly 70% 2009–2016. | Despite recent efforts to reduce the rates of groundwater pumping and increase the rate of artificial recharge of the Seaside Groundwater Basin, overdraft remains a persistent concern across MPWMD's service area.<br>Excess groundwater pumping from Cal-Am wells located within MPWMD's service area caused the Carmel River to run dry seasonally in most year types.<br><br>Pumping rates have been reduced due to conservation measures and investments in groundwater recharge, but remain above the safe yield figures established by MPWMD studies in the mid and late 2000s. | Both basins have been in a state of overdraft for some time and will require reductions in pumping and/or increases in artificial recharge in order to balance extraction with recharge.<br>The 2006 adjudication and SWRCB order in 2009 required Cal-Am to reduce its groundwater withdrawals by 2021. In April, 2016, Cal-Am, MPWMD, and others petitioned the SWRCB to modify and extend the SWRCB order to December 31, 2021 to allow more time to complete replacement water supply projects. In July 2016, the SWRCB approved the petition with modifications. | MPWMD's website indicates that saline intrusion is not yet a problem within its service area, while recent DWR documents including the most recent CASGEM report, indicate that saline intrusion has already occurred in some wells located in the coastal plain that draw water from locations north of the adjudicated Seaside Groundwater Basin (DWR defines the Seaside Area as a greater area than the adjudicated basin and as a hydrologic sub-basin of the larger Salinas Valley Groundwater Basin). |

## Desert Water Agency



# Desert Water Agency

## Overview

| | |
|---|---|
| **County** | Riverside (Desert Water Agency (DWA) service area);[345] The Indio Sub-basin as defined by the California Department of Water Resources (DWR) also underlies portions of San Diego and Imperial counties[346] |
| **Area** | 325 sq mi (DWA service area);[347] 525 sq mi (Indio Sub-basin surface area)[348] 76 sq mi (Mission Creek Sub-basin surface area)[349] |
| **Population** | 71,000 (DWA service area)[350] Approximately 105,000 including seasonal residents[351] |
| **CASGEM priority** | Medium for both Sub-basins as defined by the DWR [352]; Indio Sub-basin (7-21.01) and Mission Creek Sub-basin (7-21.02) |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Desert Water Agency's (DWA) groundwater is extracted from either two or three distinct sub-basins of the larger Coachella Valley Groundwater Basin (CVGB), depending on which agency's definitions are used. California Department of Water Resources (DWR) documents, including the most recent CASGEM assessments, indicate there are two such sub-basins: the Indio Sub-basin (Groundwater Basin # 7-21.01) and the Mission Creek Sub-basin (Groundwater Basin # 7-21.02).[353] DWA documents consistently indicate that there are three such sub-basins: the Whitewater Sub-basin and the Garnet Hill Sub-basin together comprise what DWR refers to as the Indio Sub-basin, while the boundaries of the Mission Creek Sub-basin remain the same for both agencies.[354] There is limited flow between the Whitewater Sub-basin and the Garnet Hill Sub-basin, which is why the DWR refers to these as the singular Indio Sub-basin.[355] Groundwater production from these basins is managed jointly between the DWA and the Coachella Valley Water District (CVWD), which both withdraw groundwater from the Indio Sub-basin and the Mission Creek Sub-basin. Both of these districts, together, exchange water with the Metropolitan Water District (MWD) to recharge the groundwater basins[356] (More details on groundwater recharge arrangements can be found in the sections to follow).

The Indio Sub-basin is located northwest of the Salton Sea and receives very low annual precipitation. It is bounded on the north by the Banning Fault, on the northeast by semi-impermeable rocks of the Indio Hills, and on the south by impermeable rocks of the San Jacinto and Santa Rosa Mountains. It is separated on the northwest and west by a bedrock constriction from the San Gorgonio Pass Sub-basin, while the Salton Sea forms the eastern boundary and serves as the Sub-basin's primary drainage area. A low drainage divide forms a short boundary between the Indio Sub-basin and the West Salton Sea Groundwater Basin to the southeast. Water-bearing materials in the Indio Sub-basin consist primarily of unconsolidated late-Pleistocene and Holocene-age alluvium deposits. These deposits consist of both older alluvium and the Ocotillo Conglomerate Formation, a thick sequence of poorly bedded coarse sand and gravel.[357] The Ocotillo Conglomerate Formation is over 1,000 feet thick in many places and is the most significant water-bearing unit in the Indio Sub-basin. In the upper part of the Indio Sub-basin groundwater is mostly unconfined, whereas in the south and southeastern portions most groundwater is confined. The west-trending Banning and Garnet Hill Faults, and the northwest-trending San Andreas Fault, serve as barriers to groundwater due to folded water-bearing deposits and an impermeable fault gouge.[358] Hydrologic data on flows between what DWA refers to as the "Whitewater" and "Garnet Hill" Sub-basins of the greater Indio Sub-basin have not been quantified, but it is known that recharge efforts in the Whitewater Sub-basin/Sub-area have led to increases in the water level in the Garnet Hill Sub-basin/Sub-area, suggesting that some flow between the two units occurs.[359]

The Mission Creek Sub-basin of the CVWB is also located northwest of the Salton Sea and immediately to the north of the Indio Sub-basin. The Garnet Hill Sub-area of the Indio Sub-basin lies in between the Whitewater Sub-area and the Mission Creek Sub-basin (see map in Appendix A for further details). The Mission Creek Sub-basin underlies the far northwestern portion of the Coachella Valley and is bounded on the west by impermeable rocks of the San Bernardino Mountains and on the south by the Banning fault, which separates the Mission Creek Sub-basin from the larger Indio Sub-basin. The Mission Creek Fault bounds the northern and eastern portions of the Sub-basin, while on the southeast it is bounded by the Indio Hills. Primary water-bearing deposits include relatively unconsolidated late-Pleistocene deposits, Holocene alluvial fan deposits, and terrace deposits. Pleistocene deposits include the Ocotillo Conglomerate Formation, which also underlies the Indio Sub-basin, and the Cabezon Fanglomerate, which is a boulder conglomerate with abundant sand, silt, and clay. While sediment deposits may run in excess of 7,000 feet, only the top 2,000 feet are considered to be water bearing. Water quality becomes increasingly saline at depth, and poor hydraulic connections exist between the shallower and deeper sections. High specific yields exist in much of the coarse-grained and relatively unconsolidated deposits with well yields as high as 3,000 gallons per minute (gpm) in some of these deposits. The Mission Creek Sub-basin, along with the Indio Sub-basin, is part of a large structural trough that includes the Gulf of California. The west-trending Banning Fault and northwest-trending Mission Creek Fault are the major groundwater controls in the Sub-basin, restricting flow to adjacent groundwater basins. The Banning fault forms the barrier between the Mission Creek Sub-basin and the Garnet Hill Sub-area of the Indio Sub-basin.[360]

About 95 percent of DWA water is pumped from deep wells located throughout the service area. The other 5 percent is mountain stream water from Snow Creek, Falls Creek, and Chino Creek.
DWA uses 29 active wells to pump into the water system with six pressure zones. The water system includes about 22,000 active services throughout 369 miles of pipeline and serves about 71,000 people. The agency utilizes 28 reservoirs with the capacity to store 59 million gallons.[361]

## Background to District Formation

The DWA works with the larger and older CVWD to manage the groundwater resources of the Indio and Mission Creek Sub-basins of the CVGB. Although the Agua Caliente Band of the Cahuilla Nation inhabited the Coachella Valley for centuries, Anglo settlement only began *en masse* starting in the early twentieth century. The Coachella Valley Storm Water District was first formed in 1915 to manage storm water runoff, followed by the CVWD in 1918 to promote conservation measures after residents feared that plans to export water from the Whitewater River to the Imperial Valley would leave Coachella Valley residents without their adequate share. These two districts merged into the modern CVWD under an act of the California Legislature in 1937, bringing responsibilities for drainage, storm water management, and conservation under the purview of a single agency.[362]

The Coachella Valley has extremely low annual precipitation rates and groundwater was used as the major water supply source since the early days of Anglo/Euro settlement. Over time groundwater overdraft became a significant challenge for water purveyors. CVWD voters approved the construction of an irrigation canal, protective works, and distribution system in 1947, with irrigated water delivery from Colorado River diversions beginning in 1949. During the 1940s and 1950s, a number of new water purveyors were established in the Coachella Valley, including the City of Coachella Water Department, the Desert Hot Springs Mutual Water Company, and other smaller mutual water companies that would later merge with these existing agencies.

With the onslaught of recreational development in the postwar era, especially the rapid development of Palm Springs as a resort town, the need for supplemental water and more comprehensive groundwater management in the northwestern part of the Valley became recognized. Groundwater levels began dropping precipitously during the postwar years and by 1961, the year DWA was approved, groundwater levels had already fallen by nearly 500 feet across portions of the greater CVGB.[363] DWA was established to fulfill two goals: importing water into the region for beneficial uses, and managing the groundwater basins in conjunction with CVWD. In 1968, the DWA purchased the previously independent Palm Springs and Cathedral City water companies, taking on retail water distribution for the first time. DWA initially used the imported water to meet local demand and did not actively participate in groundwater recharge. In 1973, DWA began using the imported water to replenish the underlying basins, and today it is responsible for importing water, replenishing the groundwater basins, and distributing water to consumers within its service area.[364]

## Dates

**Creation of the Special District:** 1961
**Revisions or amendments:** NA
**Other significant dates**:
1963 – DWA purchases Palm Springs and Cathedral City water companies
1973 – The first deliveries of imported water are used to replenish the groundwater basins that underlie DWA.[365]

## Special District Summary

DWA was created by a special act of the California Legislature with statutory authority over water supplies within its service area. In its documents and policies, DWA highlights maintaining reliable and cost-effective water supplies for its consumers, with a strong emphasis on ensuring future economic growth. It is focused on importing water supplies into its service area, replenishing local groundwater supplies, and collecting assessments as necessary.

DWA is the water utility for the Palm Springs area, providing service to portions of Cathedral City, the City of Palm Springs, and adjacent outlying county areas, and it also provides sewer service for portions of Cathedral City and Palm Springs. It is a rapidly growing region, and since 1990, population for the entire Coachella Valley increased by over 90 percent.[366] According to the U.S. Census Bureau, the median household income (MHI) for Palm Springs is $35,973; for Desert Hot Springs is $25,987; and for Cathedral City is $38,887. The State of California defines a Disadvantaged Community as a community with an annual MHI that is less than 80 percent of the Statewide MHI. Using the 2006 American Community Survey, 80 percent of the statewide annual MHI is $51,650.[367] Using these standards, the three cities would qualify as Disadvantaged Communities.

Since the early days of its existence to ensure reliable water supplies and promote groundwater recharge, the agency has worked closely with the neighboring CVWD, with which it shares the Indio Sub-basin. Since 1973, these two agencies have used imported water from the Colorado River to recharge the Whitewater Sub-basin/Subarea. This resulted in groundwater levels stabilizing in the early 1980s and then gradually increasing over most of the following thirty years.[368] Although DWA is a

State Water Project (SWP) contractor, there is no direct connection between the SWP aqueducts and the desert region of the Coachella Valley. Instead, DWA and CVWD together exchange diverted Colorado River water for SWP water with the MWD of Southern California. From 1973 until 2008 DWA and CVWD have replenished the Indio Sub-basin and Mission Creek Sub-basins with more than 2.1 million acre-feet (AF) of imported water.[369]

DWA is one of several participating agencies in the Coachella Valley Regional Water Management Group (CVRWMG), which was formed in 2008 and includes Coachella Valley's five public water purveyors (these include: DWA, CVWD, the Coachella Water Authority, Indio Water Authority, and Mission Springs Water District [MSWD]), along with representatives from local governments and stakeholders representing industry and the region's Native American tribes. The five different water purveyors of the Coachella Valley, which overlies the greater CVGB, serve a total population of approximately 400,000 year round—of which about 71,000 live within DWA service boundaries.

## Water Users

DWA supplies water via 23,000 individual connections to businesses and residences, serving a population of approximately 105,000 (including tourists) within its 325 square mile service area.[370] Groundwater pumped from within DWA service boundaries is used for non-agricultural purposes, including residential use, commercial use, golf course irrigation, and irrigation for landscaping. DWA provides the percentage for residential and commercial use to the State Water Resources Control Board (SWRCB) monthly.[371]

Although about 72,800 acres of agricultural land are irrigated using groundwater resources from the CVGB, nearly all of this acreage falls within CVWD's service area and is thus outside the jurisdiction of DWA.[372] Groundwater production within DWA boundaries amounted to approximately 35,000 AF for the 2014 water year, while total groundwater production in the CVGB exceeded 200,000 AF during the same period.[373] Since its establishment in 1961, groundwater production within DWA service boundaries has never exceeded more than 20 percent of total water withdrawals from the greater CVGB, making coordination with other public agencies crucial for managing the Coachella Valley's groundwater resources.

## Management Structure

A five-member Board of Directors governs DWA, with each director elected to four-year terms by registered voters residing within the DWA service area. Board members represent the district at-large, rather than any specific sub-districts or constituencies, and are paid a stipend of $380.94 per meeting.[374] The Board of Directors are responsible for overseeing the work of 75 full-time employees in 10 different departments, which include: management, engineering operations, accounting, customer service, information systems, administrative assistants, construction, facilities and safety, human resources, and outreach and conservation.[375] DWA Board Members work closely with their counterparts at the CVWD to jointly manage the groundwater resources of the region —both agencies overlie the Indio Sub-basin of the CVGB, with the CVWD covering nearly three times the land area and serving nearly five times as many customers as the DWA. For this reason, CVWD's policies have a profound impact on the groundwater resources shared by both districts.[376]

## Management Strategies

Because DWA shares its groundwater resources with other neighboring water districts, most notably the much larger and older CVWD, groundwater management and replenishment is carried out in conjunction with the other CVRWMG agencies and stakeholders. While DWA has worked closely with CVWD since its establishment in 1961, coordinated collaboration with these other three municipal water distributors is more recent. In recent years, DWA has increased the availability of recycled water, which is used by the region's golf courses and for landscaping and irrigation, and also increased conservation efforts, offering incentives for residents to replace turfgrass with drought-tolerant landscaping and to install smart irrigation controllers.[377]

DWA management strategies include the following:

*Conjunctive use*
The Coachella Valley's future water supply requires a multi-pronged strategy to reduce water use and increase the amount of groundwater being replenished in its aquifers. To that end, the DWA engages in a range of conjunctive management strategies in coordination with other public water agencies in the Coachella Valley with an emphasis on increasing imports.

*Imported water*
Given the arid climate, surface water flows within DWA service boundaries are quite limited. If groundwater replenishment with imported water (artificial recharge) is excluded, annual groundwater overdraft within the Whitewater River, Mission Creek, and Garnet Hill Sub-basins of the Upper CVGB would continue to increase at a steady rate, depending upon actual non-consumptive return flows. Supplementing natural groundwater replenishment resulting from rainfall and snowmelt runoff with artificial recharge is therefore necessary to reduce annual and cumulative overdraft, prompting a heavy reliance on imported water to meet local demand and recharge the sub-basins of the CVGB.

Since 1973, DWA has worked with the CVWD to replenish the Whitewater River Sub-basin with Colorado River water exchanged for SWP water. Also, since 2002, they have been replenishing the Mission Creek Sub-basin with Colorado River water exchanged for SWP water. The costs involved in carrying out DWA's groundwater replenishment program are recovered through water replenishment assessments applied to all groundwater and surface water production within the Areas of Benefit, aside from specifically exempted production. Producers extracting groundwater at rates of 10 acre-feet per year (AFY) or less are exempted from assessment.[378]

*Recharge*
Currently, no groundwater spreading facilities exist in the Garnet Hill Sub-basin. There are no plans to construct or operate recharge facilities in that sub-basin due to the minimal groundwater production occurring there.

*Recycled water*
To reduce drought-related impacts on the region's groundwater resources, DWA has been investing in water reuse technologies since the late 1980s. DWA and the City of Palm Springs executed a Water Conservation and Reclamation Agreement in 1977, to allow city sewer effluent to be recycled. DWA opened a five million gallon recycled water plant in 1988 and in 1995 expanded it to 10 million gallons. Currently, all public golf courses in Palm Springs use recycled water for irrigation. More recent conservation efforts include rebates for replacing lawns with drought-tolerant landscaping and mandatory restrictions on outdoor water use. DWA also offers residents $100 toward the cost of replacing older toilets with newer, more energy efficient models.

*Conservation*
The DWA recently implemented numerous conservation programs. The area has the highest evapo-transpiration rate in the state, and temperatures in the summer can be as high as 120 degrees Fahrenheit, resulting in elevated water use. Throughout the first decade of the twenty-first century, the area had one of the highest rates of per capita water use in the state, and it continues to have per capita water use rates well in excess of the state average. Despite this, per capita water consumption within DWA boundaries has decreased significantly since the start of the 2012–2015 drought.[379]

*Collaborative projects*
CVWD, DWA, and MSWD developed a Mission Creek-Garnet Hill Water Management Plan with the goal of managing the water resources to meet demands reliably while protecting water quality in a sustainable and cost-effective manner.[380]

## Monitoring and Reporting Requirements

DWA conducts water quality monitoring in accordance with state and federal laws. Because agricultural production is virtually nonexistent within DWA boundaries, most groundwater in the DWA service area is distributed at the retail level to individual households and businesses, including a large number of resorts and golf courses.[381] DWA provides these data to the SWRCB on a monthly basis.[382]

Although DWA provides metering for its retail-level customers, metering and reporting for private groundwater production is only required if annual pumping exceeds 10 AFY. DWA does not maintain comprehensive records on the total amount of private groundwater production within its boundaries, but public supply for residential, commercial, and industrial uses appears to comprise the bulk total groundwater extraction within DWA boundaries.[383]

## Safe Yield

DWA does not use the term *safe yield* in its documents to refer to the level of pumping at which withdrawals and outflows together would equal inflows. The 2015 Replenishment Assessment Engineer’s Report enumerates rates of pumping, rates of natural recharge, and the rates of artificial recharge.

In the 2015 Engineers Report, DWA’s maximum water allocations were at 55,750 AFY, with combined total allocations for CVGD and DWA of 194,100 AFY (71 percent CVWD and 29 percent DWA). With full deliveries of water allocations (with no MWD call-back or recall, and with no CDWR-reduced deliveries), plus natural supply and non-consumptive return flow, the report stated that annual water supply will be significantly greater than annual water requirements. With reduced deliveries of water allocations (in combination with any MWD call-back or recall) it stated that annual water supply may be insufficient to meet annual water requirements without groundwater from storage.[384]

## Groundwater Pumping and Overdraft

The 2015 DWA Engineers Report considered the Garnet Hill Sub-basin to be in a condition of overdraft due to its reliance for replenishment on the Whitewater River and Mission Creek Sub-basins, both recognized as being in overdraft. The report estimated that all of the aquifers within DWA boundaries are currently in a state of overdraft, due to curtailments in the availability of SWP water. It concluded that the Upper CVGB will most likely remain in overdraft until a higher proportion of the maximum SWP allocations becomes available.

Historically, water levels in the Garnet Hill Sub-basin declined steadily until recharge activities at the Whitewater Spreading Grounds commenced in the early 1970s. Groundwater levels in the Garnet Hill Sub-basin responded favorably to the recharge activities at the Whitewater Spreading Grounds, increasing by as much as 60 to 160 feet in the western and central portions of the basin, and by approximately 40 feet in the southeastern portion of the basin (southeast of Garnet Hill). However, basin recharge is reliant on receiving sufficient imported water.[385] With maximum imported water allocations, recharge in the Whitewater River and Mission Creek Sub-basins would offset the current annual overdraft. The 2015–2016 Engineers Report states that overdraft in future years is considered unpredictable, due to the difficulty of projecting long-term growth in the region and the reliability of SWP supplies.[386]

Annual production for DWA is about 43,000 AF (more than 14 billion gallons) annually. The agency replenishes the groundwater with water from the SWP. Because there is no direct pipeline from the SWP to Palm Springs, the agency exchanges water with MWD. Replenishment water comes from the Colorado River Aqueduct. DWA uses the water from two connections to fill recharge basins, located at Whitewater and Mission Creek. From 1973 to 2008, DWA and CVWD replenished the groundwater basins with more than 2.1 million AF of water at the Whitewater River and Mission Creek Sub-basins. The agency also gets water from mountain streams, including Chino Creek, Snow Creek, and Falls Creek. DWA gets about 3 million gallons a day from stream supply and about 78 million gallons per day in well capacity.

In the entire Coachella Valley, groundwater pumping outstrips the rate of natural recharge. In wet years however, DWA is able to purchase surplus SWP water, which it uses together with CVWD to recharge the CVGB. Throughout much of the 1980s and 1990s artificial groundwater replenishment efforts using imported water were generally successful, with groundwater levels stabilizing in the 1980s and beginning to increase in the latter years of the twentieth century. In 2011 a combined total of 290,869 AF of SWP water was used by DWA and CVWD for recharge. But in low precipitation years, water imports are not sufficient to offset the rate of groundwater production. By 2013, the combined total of SWP water allocated between the two districts dropped to fewer than 100,000 AF, and in 2014 the Coachella Valley received only 20 percent of its SWP allotment, while estimated pumping was more than three times in excess of safe yield for the 2014–2015 water year in the Mission Creek Sub-basin, and nearly five times in excess of safe yield for the Whitewater River area of the Indio Sub-basin. These figures include combined pumping between DWA and CVWD, which both produce and distribute groundwater from these two sub-basins.[387]

## Water Quality

The 2014 Water Quality Report states that DWA met all its major water quality targets for the 2014 water year.[388] CASGEM's summary of California's groundwater basins suggests that the Indio Sub-basin is prone to nitrate contamination, addition of salts due to imported Colorado River water, and localized areas of high naturally occurring fluoride concentrations.[389] However, it is important to note that the Indio Sub-basin is shared between DWA and CVWD, so the areas with high levels of contaminants may lie outside of DWA boundaries. Likewise, the state CASGEM summary also suggests that the Mission Creek Sub-basin is prone to radiological contamination and nitrate contamination, but the 2014 DWA Water Quality Report indicates that DWA met its targets for both of these parameters.[390,391] It may be that contamination is a greater issue in the portions of these sub-basins that fall under CVWD jurisdiction, or that there were historical issues with these contaminants that have now been rectified.

## Disputes

On May 14, 2013, the Agua Caliente Band of Cahuilla Indians (hereinafter "Tribe") filed a lawsuit, against DWA and CVWD, claiming that its federal reserved rights under the doctrine of *Winters v. United States,* 207 U.S. 564 (1908), extended to the region's groundwater resources. Moreover, the federal reserved water rights had to "satisfy the present and future needs of the Tribe and its members" and be protected from overdraft and degradation.[392]

On March 20, 2015, a federal court ruled that the lawsuit had to proceed to trial to determine if the Tribe does indeed have federal reserved rights to the groundwater resources of the Coachella Groundwater Basin.[393] In 2015, the court concluded the Tribe's federal reserved water rights may include groundwater, but the Tribe's aboriginal right of occupancy was extinguished long ago, so the Tribe has no derivative right to groundwater on that basis.[394] The water districts filed a petition with the U.S. Court of Appeals for the Ninth Circuit for interlocutory review of the portion of the District Court's order addressing the tribe's reserved right to groundwater, and it was granted.[395] On February 23, 2016, a California federal judge granted partial summary judgment to the federal government and the Agua Caliente Band of Cahuilla Indians, ruling that DWA and CVWD could not assert equitable defenses against the tribe's declaratory relief claims.[396] If the Ninth Circuit affirms the results of the Phase I trial, Phase II will address whether the tribe owns pore space beneath the reservation, whether there is a right to water of a certain quality, and how to quantify the tribe's federal reserved water right. If necessary, Phase III will quantify the tribe's federal reserved rights to underground water and pore space and order injunctive relief. These rulings could have a significant impact on water availability for both DWA and CVWD.[397] The Tribe has not disclosed what it intends to do with the groundwater if it wins its lawsuit, but it does not currently operate any pipes, pumps, or water delivery infrastructure and is not currently a significant consumer of groundwater within the region.[398]

Additional disputes occurred between the MSWD, CVWD, and DWA. In October 2003, MSWD filed action in the Superior Court of the State of California against DWA seeking a writ of mandate, declaratory relief for prescriptive and appropriative water rights, and declaratory and injunctive relief for a physical solution of a groundwater basin. MSWD sought to adjudicate the Mission Creek Sub-basin. CVWD and DWA challenged the complaint. In 2004, MSWD, DWA, and CVWD reached a settlement agreement stating that the agencies would jointly manage the sub-basin, and including provisions regarding payment of replenishment assessment charges, shared costs for basin studies and development of a Basin Management Plan for the Mission Creek and Garnet Hill Sub-basins that was approved in 2008.[399]

## Discussion

DWA's success in managing its groundwater resources is heavily dependent on its ability to import water to recharge its groundwater basins, a burden it shares with the other public agencies responsible for managing groundwater within the Coachella Valley. To that end, DWA has entered into negotiations with the SWP at various points over the past few decades to increase its entitlements to SWP water.[400] While the aggregate amount of SWP water to which Coachella Valley water districts are entitled has increased since the 1970s, the availability of SWP water in dry years has often fallen far short of these entitlements. DWA was successful in stabilizing and eventually increasing groundwater levels across much of its service area from the 1980s into the first decade of the twenty-first century.

In years that DWA receives its full allocation of SWP water, supply exceeds annual demand, allowing the District to further recharge its groundwater aquifers, but average SWP deliveries in recent years have averaged well below these amounts.[401] For this reason, the past few years have seen both the Indio Sub-basin and the Mission Creek Sub-basin of the greater Coachella Valley Groundwater Basin fall back into a state of overdraft. Although recent conservation measures have met their intended targets for reducing water use, the DWA service area, along with the rest of the Coachella Valley, still has one of the highest per capita water use rates in the State of California.

## Analysis

1. Being an arid, desert region, annual demand across the CVGB exceeds what can be produced naturally without imported water resources. If groundwater replenishment with imported water (artificial recharge) is excluded, annual groundwater overdraft (groundwater extractions or water production in excess of natural groundwater replenishment or recharge) within the Whitewater River, Mission Creek, and Garnet Hill Sub-basins of the Upper CVGB would have continued to increase at a steady rate, depending upon actual non-consumptive return flows. Supplementing natural groundwater replenishment resulting from rainfall and snowmelt runoff with artificial recharge is therefore considered necessary to reduce annual and cumulative overdraft and avoid declines in groundwater levels, and the continued availability of imported water from both the SWP and the Colorado River is crucial to DWA's efforts to recharge its groundwater aquifers. In years that DWA receives its full SWP entitlement it is able to recharge its groundwater basins with more water than is extracted. Recent years have seen sharp curtailments in the availability of SWP water, causing groundwater levels to drop in some areas once again after many relatively stable years.

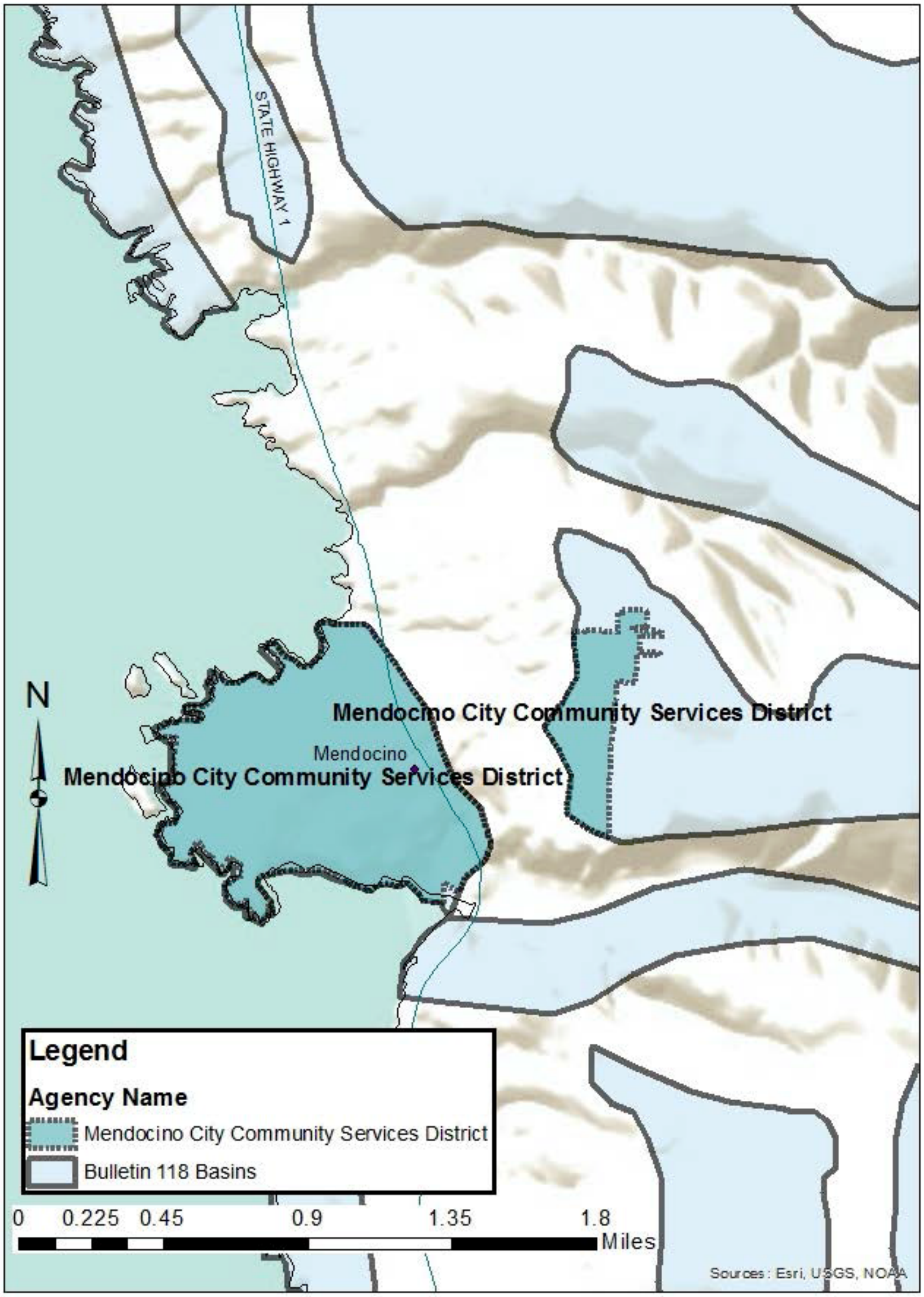
2. The success of DWA in managing its groundwater resources will be inextricably linked to its ability to coordinate with neighboring water districts in the Coachella Valley with which it shares the same groundwater basins, most notably the CVWD. In total, DWA serves some 71,000 water users in the Coachella Valley, only a small fraction of the total 400,000 residents of the Coachella Valley who share the groundwater resources of the greater CVGB. Moreover, most agricultural production in the Coachella Valley takes place outside of DWA boundaries. Since DWA's establishment in 1961, it has worked closely with CVWD, and most public documents published by DWA refer to these agencies' joint plans for replenishing groundwater resources.

3. In the Agua Caliente Band of Cahuilla Indians' lawsuit against DWA and CVWD, the District Court held that the Tribe's federal reserved rights extended to the region's groundwater resources in an amount sufficient to "satisfy the present and future needs of the Tribe and its members" and it was to be protected from overdraft and degradation. That decision was appealed, and on February 23, 2016, a California federal judge granted partial summary judgment to the federal government and the Agua Caliente Band of Cahuilla Indians. If the Ninth Circuit affirms the results of the Phase I trial, Phase II will address whether the tribe owns pore space beneath the reservation, whether there is a right to water of a certain quality, and how to quantify the tribe's reserve water right. If necessary, Phase III will quantify the tribe's rights to underground water and pore space and order injunctive relief. This could have a significant impact on water availability for both DWA and CVWD.

| Funding | Enabling Legislation |
|---|---|
| **1. Water revenue from ratepayers:** Fees collected from the public water provision are a major source of DWA revenue.<br>**2. Property Taxes:** Recent changes in federal law exempting tribal developments from such taxes have reduced the total share of property taxes collected by about 30%.<br>**3. Bond Issuance:** DWA has the authority to issue bonds.<br>**4. DWA also has the authority to issue negotiable promissory notes at interest rates not to exceed 7%.** This does not appear to be a major source of revenue. | **Regulate pumping:** Yes (only producers whose extractions exceed 10 AFY)<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>While not currently a significant part of DWA's water portfolio, recycled water has been a major area of investment for about 30 years.<br>**Regulate water transfers:** Yes<br>**Governing body elected by all the voters or just property owners:** At-large Board of Directors **elected by all registered voters living within the service area**. |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
|---|---|---|---|---|
| DWA does not use the term *safe yield* in any of its documents to refer to the level of pumping at which withdrawals and outflows together would equal inflows. The 2015 Replenishment Assessment Engineer's Report enumerates total rates of pumping in AF, the rates of natural recharge, and the rates of artificial recharge. | In 2015–2016, estimated combined assessable production was 47,430 AF for the Whitewater River, Mission Creek, and Garnet Hill Sub-basins.<br><br>DWA's *maximum* water allocations are 55,750 AFY (but this requires complete development of SWP water, which currently has only about half of the water supply capacity to meet this allocation).[402] | During the 1980s and 1990s, groundwater levels rose across most of the various sub-basins of the Coachella Valley in response to diverted Colorado River water and exchanges with the MWD for SWP water.<br><br>In 2015, all of the aquifers within DWA boundaries are in a state of overdraft, due to curtailments in the availability of SWP water. The Upper CVGB will most likely remain in overdraft so until a higher proportion of the maximum SWP allocations becomes available.<br>Thus the continued availability of this imported water is crucial to DWA's efforts to recharge its groundwater aquifers, and recent years have seen sharp curtailments in the availability of SWP water. | Since 2012, the groundwater basins of the Coachella Valley have been in a state of overdraft due to reduced deliveries of SWP water.<br><br>Majority of pumping occurs within the service area of the neighboring CVWD, with which DWA shares groundwater aquifers. | In the 2015 water year SWP water was only 20 percent, causing groundwater levels to drop in some areas once again after many relatively stable years. |

## Mendocino City Community Services District



# Mendocino City Community Services District

## Overview

| | |
|---|---|
| **County** | Mendocino |
| **Area** | <1 sq mi[403] |
| **Population** | About 1,000 permanent residents (plus significant seasonal influx of tourists)[404] |
| **CASGEM** | The town of Mendocino is underlain by the "Fort Bragg Terrace Area" groundwater basin, a "Very Low" priority basin.[405] |

CASGEM = California Statewide Groundwater Elevation Monitoring

Groundwater is the primary source of water supply for the Town of Mendocino, established in 1851. The town is located on the Mendocino Headlands, a broad headland peninsula that is bounded on three sides by sea cliffs that range in height from 40 to 100 feet. Approximately 400 individual wells are used to supply both commercial and domestic water usage from an area of approximately one square mile.[406]

The Mendocino Headlands Aquifer, the source of water for the Mendocino City Community Services District (MCCSD), is an open system; each year most groundwater flows through springs in the rock formation and into the Pacific Ocean rather than remaining in storage. The Mendocino Headlands lie within an area of the Coastal Range characterized by high ridges and narrow valleys.[407] The geology of the Headlands consists of Franciscan Bedrock overlain with Quaternary Marine Terrace Deposits. The Franciscan Complex rocks range from thinly inter-bedded greywacke sandstone and shale to more massive greywacke with discontinuous shale beds.[408] The Franciscan Complex has very low primary porosity with rocks typically well-indurated and cemented. However, rocks of the Franciscan Complex contain significant secondary porosity due to a pervasive system of rock fractures. Though this secondary porosity is believed to decrease with depth, most wells within the MCCSD service area pump water from zones of fractured rock.[409]

Physical attributes of the coastal Mendocino Headlands are a significant influence on groundwater flows in the area, with groundwater found in both the Marine Terrace Deposits and in the rocks of the Franciscan Complex. DWR Bulletin 118 states that the terrace deposits are the primary water bearing formation although many wells may extend into bedrock. MCCDS notes that while the Franciscan Complex is generally considered a non-water bearing formation, on the Medocino Headlands, they are the primary water yielding geologic unit, likely due to the relative thinness of the Marine Terrace Deposits in the Headlands.[410] The Marine Terrace Deposits play a crucial role in maintaining groundwater elevations at usable levels throughout much of the summer dry season. The primary porosity of the sands of the Terrace Deposits is much greater than the secondary (fractured) porosity of the underlying Franciscan Complex, providing an important contribution to the overall recharge and groundwater storage capabilities for the Town of Mendocino by enabling residents to produce groundwater from the Franciscan Complex layer.[411]

There is no known or predictable pattern to rock fracturing within the Mendocino Headlands aquifer, yielding high variability and unpredictability in pumping capabilities between wells located in close proximity to one another.[412] Flow rates typically range from less than 1 gallon per minute (gpm) to over 25 gpm. Wells which produce above 10 gpm are considered high yield wells in this area, while typically high yield wells in most areas produce over 100 gpm. Higher flow rates are typically for short time intervals and during high water level periods during the winter months.[413]

Additionally, unlike most California groundwater basins, which contain alluvial sediments surrounded by low permeability bedrock that keeps groundwater in the basin, the Mendocino Headlands aquifer is heavily dependent on annual precipitation inflows to meet its basic annual demand. This adds to groundwater levels typically showing strong seasonal variation—following the last large rainfall in the spring, groundwater levels begin a recurring annual summer decline. Privately owned and operated pumping wells effectively intercept groundwater that would have otherwise discharged to the ocean through the springs along the cliffs of the Mendocino Headlands.[414]

Because of the low yields and seasonal variation, most properties employ storage tanks and, through the MCCSD, the community has implemented significant water conservation measures. Even so, some wells run dry in the late fall months, and water is trucked in to replenish storage tanks at several properties on a regular basis in the fall. This practice is relatively limited in normal and above average precipitation years, but becomes widespread during periods of drought.[415]

Despite the fact that groundwater elevations are closely tied to annual precipitation cycles, other hydraulic controls are present that limit the minimum and maximum groundwater levels. When groundwater levels reach the surface, as they often do in many locations during winter storms, groundwater is discharged into surface drainages such as streams and ditches.[416] Minimum groundwater elevations are believed to be the result of a combination of physical limits and hydraulic processes. Physical limits include lower hydraulic levels that are set by the elevation of cliff seepage points and springs. Limiting hydraulic processes include the rate of seepage from the Terrace Deposits into the underlying Franciscan Complex and the fraction of the delayed recharge effect from precipitation that has slowly percolated through the soil and unsaturated zone sediments.[417]

## Background to District Formation

The town of Mendocino was established in 1851, and for the first 120 years of its existence had no public water or wastewater system of any kind.[418] MCCSD was founded on January 19, 1971, to manage the town's wastewater after a study by the Mendocino County Health Department found pervasive, unsafe levels of coliform bacteria in most of the town's domestic wells. Contaminated water was also suspected to be the cause of a mass hepatitis outbreak that same year, but this was never confirmed by any formal study. For the first decade of MCCSD's existence, its sole task was overseeing the construction and operation of the town's wastewater treatment plant, which first went online in 1975.[419]

In 1985, a local ballot measure passed by a margin of 141 to 76, approving the expansion of MCCSD's scope to include the acquisition of "powers regarding water as set forth in the California Public Contract Code Section 20681 (a)."[420] This measure was intended primarily to grant the District authority to pursue the construction and operation of a public water supply system. Following the 1985 election, the District spent several years pursuing the possibility of finding a water source sufficient in both quality and quantity to provide a public water supply system to Mendocino town residents. These efforts were ultimately unsuccessful, and in 1987 the California legislature passed Water Code 10700-10717, providing the MCCSD with additional authority to manage and regulate groundwater resources within its service area.[421]

In 1990, the MCCSD formally assumed full responsibility for managing the town's groundwater resources from Mendocino County officials. This process involved adopting a Groundwater Management Plan (GMP), implementing and Groundwater Extraction Permit Ordinance (Ordinance 90-01), and entering into agreement with the Mendocino County Health Department to regulate groundwater extraction within MCCSD boundaries and perform water quality monitoring.[422] In more recent years, the MCCSD has implemented further regulations aimed at preventing overdraft by restricting non-essential uses, and has implemented aggressive rationing schemes in response to the current drought (see sections below for further details).

## Dates

**Creation of the Special District:**
1971 – MCCSD was not originally created for the purposes of managing groundwater
**Revisions or amendments:**
1985 – Local voters approve expanding MCCSD's authority beyond its original scope of wastewater management.
1987 – The state legislature approves Water Code 10700-10717, formally granting the District authority to manage the groundwater resources located within its boundaries. The District formally assumes these duties beginning in 1990.
**Other:**
1990 – MCCSD assumes full responsibility for managing and regulating groundwater located within its boundaries, as authorized by AB 786. The District Board of Directors votes in favor of a Groundwater Extraction Permit Ordinance 90-1.[423]

## Special District Summary

The history of water planning in the area of the Town of Mendocino is closely associated with the development and control over extraction of groundwater in response to historical and geographical limitations over water access and land development. Groundwater is a critical resource since there are no surface reservoirs, and riparian rights are very limited. Since 1987, the MCCSD has maintained authority for the management of groundwater resources within its service area, and it manages the groundwater supply of the Town of Mendocino. The enabling legislation provides the MCCSD with authority to regulate pumping.[424] While many residents receive private tanker deliveries during the summer, the power to import water was not formally granted in the legislation. Water transfers are not practical given the open aquifer system of the Mendocino Headlands.

In 1990, the MCCSD adopted an Ordinance for Groundwater Extraction Permits authorized by Assembly Bill (AB) 786. As part of this legislation they entered into an agreement with the County of Mendocino Public Health Department to regulate groundwater extraction within district boundaries and honor the groundwater extraction allotments issued by the county prior to MCCSD Groundwater Management Program authority.[425]

## Water Users

Groundwater production in the Town of Mendocino primarily supplies domestic and commercial uses. There is no commercial agriculture located within MCCSD's service area, and the MCCSD's annual water budget is very low when compared with most other Special Act Districts in California. Total annual water consumption within MCCSD boundaries has declined from 306 AF in the 2001–2002 water year to 221 AF in 2011–2012.[426] MCCSD has mandated a 40 percent reduction in total water use in response to the 2012–2015 drought, and estimates that it is on track to achieving this target.

A more comprehensive breakdown of water users by category by water year can be found in Table 16. For the 2011–2012 water year, the most recent one for which comprehensive data are available, residential use comprised the single largest category, with an approximate 43.08 percent of total water use within MCCSD boundaries. Commercial uses are subdivided into three separate categories—hotels and short-term rentals, bars, and restaurants/retail—which, when taken together, account for approximately 52.66 percent of total water use, slightly eclipsing the totals for residential use.

**Table 16: Water Use by Category: Amounts are in gallons/day, unless otherwise indicated**[427]

| Water Year | 2000–01 | 2001–02 | 2002–03 | 2011–12 |
|---|---|---|---|---|
| **Water Use Category** | | | | |
| Residential | 80,420 | 80,720 | 80,820 | 85,180 |
| Inns, Hotels, B&Bs, Vac. Home Rentals | 56,600 | 58,600 | 39,400 | 41,400 |
| Restaurants, Bars | 59,634 | 59,633 | 52,335 | 34,700 |
| Retail, Office, Grocery, Service Station, Home Occupation, Personal Services, Gov. Buildings | 25,322 | 25,183 | 26,619 | 27,980 |
| Library, Art, and Community Center | 2,000 | 2,150 | 4,190 | 1,257 |
| Churchs, Halls | na | 7,565 | 3,822 | 3,765 |
| Ballpark | na | 800 | 800 | 1,200 |
| Rainbow School | 12,150 | 11,625 | 11,190 | 240 |
| Headlands Park | 25,000 | 24,990 | 24,990 | 2,000 |
| **TOTAL (gpd)** | **261,126** | **272,466** | **244,566** | **197,722** |
| **TOTAL (AFY)** | **293** | **305** | **274** | **221** |

## Management Structure

MCCSD is governed by a five-member Board of Directors, with each Director serving either a two- or four-year term.[428] Elections are held in November of odd-numbered years, and any registered voter living within MCCSD boundaries may apply for the office of Director when there is a vacancy. Given the small size and population of the MCCSD's service area, most recent elections for Board of Director have been non-competitive with only one candidate running for each available position.[429] In addition to the Board of Directors, MCCSD employs four staff. Staff positions include: District Superintendent, District Secretary, and Plant Operator (two positions).[430] MCCSD also periodically relies on a Fort Bragg-based law firm to provide legal services.

## Management Strategies

Groundwater is the primary water supply for the Town of Mendocino, with the exception of tanker truck imports that occur in the dry months of drier years. Approximately 400 privately owned and operated wells supply groundwater for residential and commercial purposes within MCCSD boundaries. Two major strategies for managing these groundwater resources are the implementation of groundwater extraction permitting regulations and mandatory water conservation requirements. These two strategies were first outlined in the original GMP of 1990, when MCCSD took responsibility for managing the town's groundwater resources for the first time, and have been subject to several subsequent rounds of revisions, with the most recent in the 2012 GMP.[431]

To help prevent well interference that can adversely affect closely spaced wells, and to limit groundwater withdrawals to prevent exceeding the perennial yield, MCCSD adopted a Groundwater Extraction Permit Ordinance and a Groundwater Management Plan. New development projects are approved if aquifer pump tests show that the new well does not adversely impact existing adjacent wells or the aquifer. MCCSD regularly updates its groundwater model to ensure that the perennial yield is not exceeded.

*Groundwater Extracting and Permitting Regulations*
The District's extraction permit ordinance requires residents to apply for extraction permits for any of the following activities:

- Extracting groundwater for a new development
- Expanding any existing use of groundwater
- Any change in use of groundwater, or constructing or modifying a well within the District service area[432]

There have been six amendments to the original extraction permit ordinance. These served to tighten requirements for issuing a valid permit by mandating additional hydrologic studies and aquifer test procedures before a permit is issued. The most recent modification to the extraction permit ordinance (Ordinance 07-01) passed in 2007, updating the aquifer testing protocol in the Hydrological Testing Guidelines and updating administrative procedures for issuing groundwater extraction permits. Under current guidelines, applicants must first prove that there is adequate groundwater in the proposed well site for beneficial use, without negatively impacting water levels in other test wells within District boundaries. The burden of proof is on the applicant to ensure this can be achieved. Once proof has been established, in accordance with guidelines outlined in MCCSD policy, MCCSD shall issue a groundwater extraction permit. No more than one such hydrological study may be conducted at any one time within MCCSD boundaries. This is intended to ensure greater accuracy in determining whether a proposed project will negatively impact the water levels in other wells. All completed studies must then be referred to a Board of Director's approved hydrologist for third-party review, and a public hearing on the proposed development must then be held as a part of the permitting process. Additionally, meters and water conservation devices must be installed on all new developments, in accordance with the permitting ordinance.[433]

*Water conservation*
Water conservation programs are the other major part of MCCSD's groundwater management strategy, and these have expanded in scope in recent years to include gray water reuse for landscaping and recreational purposes. Even before MCCSD assumed responsibility for groundwater management activities, the Town of Mendocino had one of the lowest per capita use rates in California, with an estimated 70 gallons per day (gpd) per capita in the late 1980s.[434] MCCSD has long issued residents a series of non-binding directives aimed at water conservation, and has more recently mandated curtailments in per household consumption in response to the current drought. Directives that MCCSD has emphasized since the original GMP include the following:

- All new development should incorporate water conservation technologies in all stages of planning and development and should aim to only use the most water efficient fixtures available
- The installation of high-efficiency watering systems, such as drip irrigation is highly recommended for all landscaping and outdoor use

- Whenever feasible, all new development should aim to capture rainwater for groundwater recharge
- Cluster development should be promoted to the greatest extent possible
- Existing natural drainage areas should be preserved to the greatest extent possible
- Flood plains and aquifer recharge areas should remain as undeveloped open space[435]

These recommendations have been a part of every publicly available GMP produced by MCCSD since it gained the authority to manage groundwater in 1990. Though MCCSD lacks the authority to enforce many of these requirements, the general public has implemented a large portion of its recommendations. Voluntary and mandatory water conservation efforts have been successful in Mendocino, making the town one of the most efficient water users in the state. Relatively high property values (when compared to local income), small lot sizes, and the cool year-round climate, however, may also play a role in explaining why Mendocino has one of the lowest rates of household water use in the state. Based on a 2011 Water Use Demand Review, water use in Mendocino was 42 percent of the expected water demand for the existing development in the community.[436]

MCCSD also engages in a number of public outreach programs to educate residents about conservation strategies and recommendations. MCCSD uses an ongoing public awareness campaign by mailing residents information packets with conservation strategies and up-to-date information on current groundwater conditions. This information includes information on water levels and water quality from each of the District's 24 monitoring wells (these are all privately owned wells whose operators have agreed to let the District collect data for the purposes of water quality/level monitoring), along with guidelines for recommended drought-tolerant plants and information on the most efficient drip irrigation techniques.[437] Voluntary and mandatory water conservation efforts have been successful in Mendocino. Based on a 2011 Water Use Demand Review, water use in Mendocino was 42 percent of the expected water demand for the existing development in the community. The Water Conservation Program has helped reduce groundwater extraction and conserved the groundwater resource.[438]

Since the 1990 GWMP ordinance adoption, additional groundwater management programs have been added to the GWMP: (1) the Water Recycling Program, (2) the Groundwater Monitoring Program, (3) the Data Management Program, and (4) the Water Shortage Contingency Plan.

*Water recycling*
MCCSD has overseen water reclamation and recycling programs since 1997 when it entered into a partnership with Mendocino High School to install and operate a water reclamation system for irrigating the school's athletic fields. Since the 1990s, the use of reclaimed water has expanded to include an irrigation system shared by the local middle and elementary schools, and an irrigation system for Friendship Park, the largest park within MCCSD boundaries. Using reclaimed water to irrigate the school athletic fields saves more than 2 million gallons per year alone, an amount equivalent to 11 days of water use for all production for all users within MCCSD's service area. Water conservation is emphasized as a part of the local school curriculum, and past members on the Board of Directors have also been active in the local school district.[439]

## Monitoring and Reporting

All new wells built after MCCSD assumed responsibility for groundwater management in 1990 have been required to install meters and report withdrawals as part of the permitting process. A monitoring well network was developed with 24 monitoring wells that are representative of the vertical and lateral dimensions of the aquifers, and each monitoring well log was reviewed to ensure that the well tapped the monitored aquifer. Data collected from each monitoring well is entered into a computer database. Inspections to ensure that meters are installed properly are also part of the permitting process.[440]

Changes in average groundwater levels have been monitored in the revised well field since October of 2002, and these data indicate that changes in groundwater storage are directly related to annual precipitation and are not due to increased groundwater extraction, since Mendocino water demand has declined since 2002.[441]

In response to the current drought, MCCSD issued a Stage 4 water shortage on February 24, 2014, which mandated that all users curtail their consumption by 40 percent, and required all well operators within MCCSD's service area to go through the groundwater extraction permitting process and install retrofitted meters on wells to ensure compliance with the new drought-related restrictions. Three months after a Stage 4 water shortage was declared, more than 60 percent of all wells operating within MCCSD boundaries had recently installed meters, and compliance is now believed to be close to 100 percent.[442]

## Safe Yield

A 1985 DWR study was the first formal attempt to quantify safe yield for the Mendocino Headlands Aquifer, and serves as the basis for much of MCCSD's original GMP. The 1985 study estimated inflow for the 1984–1985 water year—a year that saw precipitation totals at 75 percent of their historical averages—and found that of the 928 AF of precipitation that fell within the study area, approximately 470 AF percolated into the groundwater aquifer system.[443] Using longstanding historical precipitation averages as a benchmark, the same study then calculated average safe yield to be about 625 AF, or equivalent to about roughly half the annual precipitation that falls on the Mendocino Headlands.[444] This study used an average annual rainfall figure of 42.31 inches to come up with the figure of 625 AF. The last two water years have seen rainfall totals of 24.15 and 22.26 inches respectively, suggesting that most of the groundwater flowing through the Mendocino Headlands aquifer system is currently being used by town residents.[445] However, it is not clear from the available data the extent to which the relationship between safe yield and annual precipitation totals is linear, as the original 1985 study only used one water year as a reference point. It is also unclear whether multiple, consecutive dry or wet years may have a compounding, cumulative effect on safe yield estimates.

The perennial yield, that defines the rate at which water can be withdrawn perennially without producing an undesired result,[446] is important. The undesired result is defined as a long-term decline in water levels and the depletion of groundwater storage in the aquifer.

A computer-generated groundwater model was run for the 2002–2004 period by a private consulting firm using funds from DWR. The model is well calibrated based on the comparison of model results to historical data across the aquifer, and is ready for use in forecasting future case scenarios. The overall water balance based on the calibrated MODFLOW model is 1,212 AFY (Table 17). Perennial yield includes groundwater pumpage plus the change in storage. Total groundwater pumpage is 250 AFY. During this time, groundwater storage increased by 9 AFY. Together, these two components contribute 259 AFY toward the perennial yield. By assuming that 5 percent of the cliff discharge could be captured by groundwater extraction well, this would add an additional 24 AFY. By adding the groundwater pumpage, increase in storage, and potential discharge available for capture, the estimated perennial yield for the Mendocino Headlands aquifer based on the Mendocino Groundwater Model is 283 AFY. The Groundwater Model has been updated three times since development as additional groundwater data became available. The results of this model however do not indicate the extent to which this figure may vary based on annual precipitation totals, but does suggest that safe yield is lower than originally stated.[447]

**Table 17: Model-based hydrologic budget summary used for 2004 perennial yield estimate[448]**

| Year | Total Inflow | Total Outflow | Change in Storage |
|---|---|---|---|
| **1984–1985** | 908 | 1,038 | -130 |
| **1997–1998** | 1,604 | 1,476 | 128 |
| **1998–1999** | 1,412 | 1,320 | 92 |
| **1999–2000** | 1,184 | 1,158 | 26 |
| **2000–2001** | 886 | 974 | -88 |
| **2001–2002** | 1,103 | 1,174 | -71 |
| **2002–2003** | 1,388 | 1,283 | 105 |
| **TOTAL** | **8,484** | **8,423** | **62** |
| **7-year Average** | **1,212** | **1,203** | **9** |

## Groundwater Pumping and Overdraft

Because the Mendocino Headlands Aquifer functions more as an open system than other groundwater basins in the state, it is not possible for residents to pump in excess of perennial yield for multiple years in a row, as is possible in alluvial basins with greater storage capacity. The fact that many wells go dry in below-average precipitation years (and that some wells even go dry in near-median precipitation years) indicates that annual pumping exceeds the rate of recharge in drier years. In wet years, there is generally enough groundwater to meet local demand, but it remains unclear from the available data precisely what the relationship is between annual precipitation totals and safe yield.

Because of the rather unusual hydrogeology of the Mendocino Headlands, land subsidence and saline intrusion are not cause for concern, as they are in many other groundwater basins in the state of California. All of the groundwater produced within MCCSD boundaries is located above sea level, with outflows into the Pacific Ocean through springs that are located anywhere from 5 to 100 feet above sea level, depending on the variations in the terrain of the headlands.[449] Over-production of groundwater has long been a concern for local residents and has persistently served as an impediment to more intensive development projects.

## Water Quality

Water quality has improved considerably since MCCSD first began operating its wastewater treatment facility in 1975. The unsafe levels of coliform bacteria and periodic outbreaks of disease have been addressed and remedied.[450] The MCCSD does not maintain publicly available data of commonplace water quality monitoring parameters.

## Disputes

There were two small claims records filed more than a decade ago involving pricing disputes for amounts of less than $200, but no records of more significant lawsuits involving MCCSD's groundwater activities.

## Discussion

In many regards, MCCSD oversees one of the most efficient Special Districts in the state of California, but also faces a number of unique challenges due to its particular hydrogeologic profile. Even before MCSSD assumed responsibility for groundwater management activities in 1990, local residents had some of the lowest rates of per capita water consumption anywhere in California, and those rates have decreased further in recent years. MCCSD's groundwater extraction permitting program has among the most rigorous requirements for issuing new groundwater production permits of any Special District in the state of California, and its mandate and numerous public documents emphasize a local ethos of conservation and environmentalism.[451] MCCSD continues to promote further reducing per capita water use, but many wells do run dry on a regular basis during the latter parts of the dry season. The sparse population of the town, its severely limited natural water resources, and its relative geographic isolation from larger population centers make importing water from elsewhere in the state cost-prohibitive, and the cumulative effects of a continued drought are not yet well known, making it uncertain how MCCSD will weather a longer-term drought.

## Analysis

1. Though every groundwater basin and Special Act District has its own unique physical and governance attributes, MCCSD's reliance on an open aquifer system to meet local demand presents particular challenges. While most groundwater basins in California consist of alluvial sediments surrounded by low-permeability bedrock, holding groundwater in place and leading to long natural residence times, most annual inflows into the Mendocino Headlands aquifer are discharged into the Pacific Ocean the very same year, barring significant human intervention. This presents MCCSD with a number of physical and governance challenges that are not shared by other Special Act Districts in the state.

2. Seasonal variability in groundwater is more significant than variation from year to year. Artificial recharge for storage does not present the same potential for sustainably managing groundwater resources as it does elsewhere in the state, though further increasing storage tank capacity may be one pathway forward. Moreover, two or more years of drought are likely to have severe impacts that cannot be fully mitigated by water demand reduction management. Alternatives may be to reduce demand through conservation, enhance supply through innovative use of recycled water, or to develop another supply. A potential new supply could involve sharing of water rights that are now reserved for other users, including surface water rights in the Big River. Other options, such as a desalinization plant, are infeasible for a small town until such time that the technology is sufficiently improved to reduce costs. At this time, keeping annual production below the rate of recharge is absolutely crucial for ensuring the availability of water for local residents and the tourist industry.

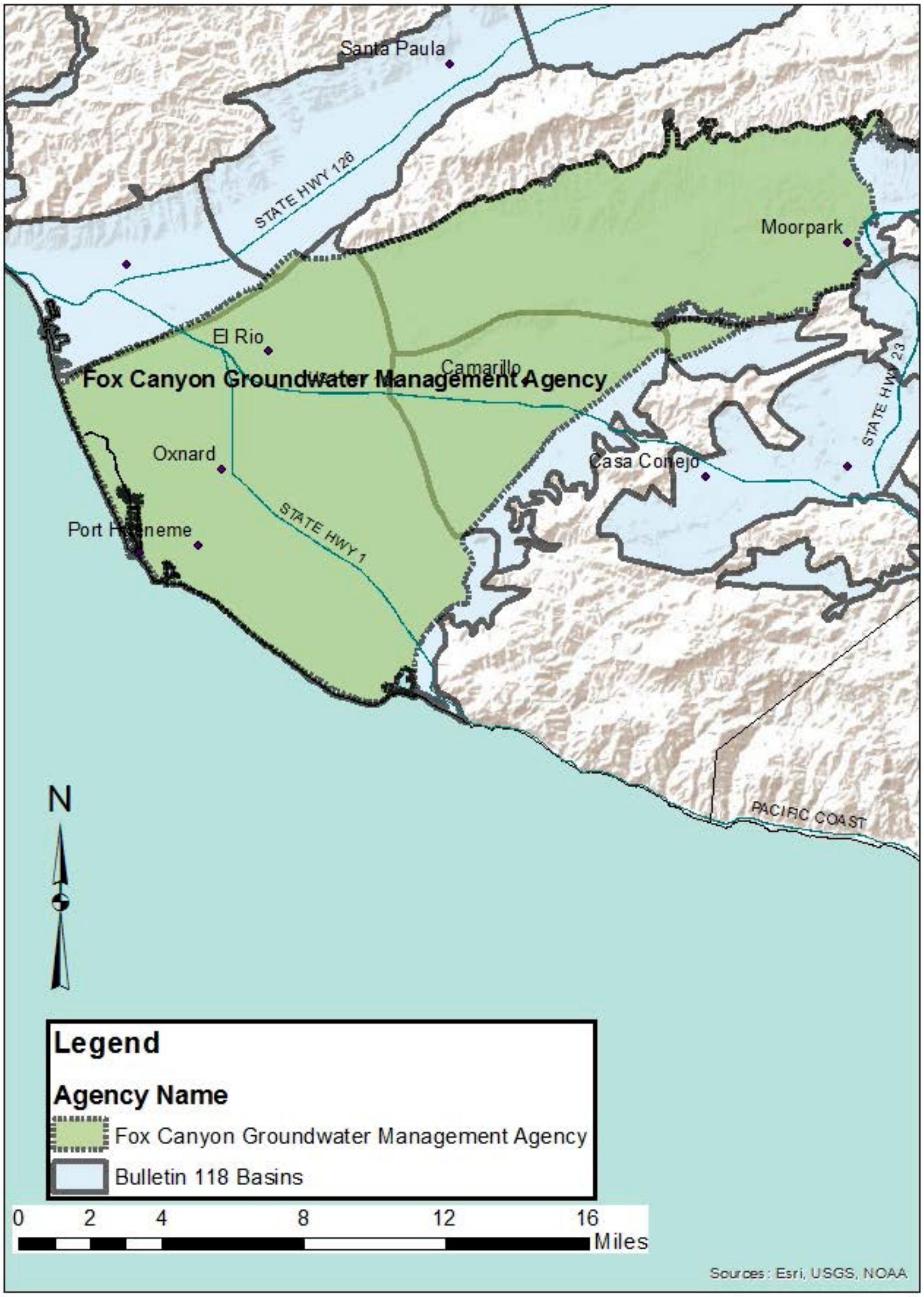
3. Because aquifer storage is minimal, the imperative not to exceed safe yield was present since before MCCSD assumed responsibility for groundwater management in 1990. Water scarcity was a defining feature of the Town of Mendocino's (limited) development, and summer water

shortages recurred for decades. Even before there were any formal groundwater regulations, local residents were among the lightest consumers of water in the state, and consumption has only continued to decline since then, accelerating in response to the current drought. MCCSD is one of the few Special Act Districts that requires metering and reporting of all wells, including small-scale domestic production, and mandates retrofitting all old wells with meters.

| Funding | Enabling Legislation |
| --- | --- |
| **Funding is not mentioned specifically in the legislation granting MCCSD groundwater management authority, but the District appears to draw on the following sources of revenue:**<br><br>**1. General Obligation Bonds:** Much of the District's existing public infrastructure, namely its wastewater treatment facility, was financed using municipal bonds.<br><br>**2. Permitting and extraction fees:** MCCSD assesses permitting fees for all well modifications and all wells constructed after 1990, when it assumed groundwater management authority.<br><br>**3. Property Tax Revenue:** This is not mentioned anywhere in the legislation granting groundwater management authority, nor in any MCCSD policy documents, but a recent local newspaper article indicates that an *ad valorem* parcel tax revenue is unrestricted and may be used as needed by the District to help close budget shortfalls. (For further details see: http://www.mendocinobeacon.com/article/NN/20150709/NEWS/150709989) | **Regulate pumping:** Yes<br>**Import water:** No (Many residents receive private tanker deliveries during the dry summer months, but this power was never formally granted to the District.)<br>**Reclaim flood and storm water:** No (Most residents maintain private storm water storage systems. MCCSD's role in managing groundwater is purely regulatory, as per California Water Code Sections 10700-10717.)<br>**Regulate water transfers:** No (Water transfers are not practical, given the open aquifer system of the Mendocino Headlands.)<br>**Governing body:** At-large Board of Directors **elected by all registered voters living within the service area.**<br>**Enabling legislation** granting MCCSD groundwater management authority, see http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=10001-11000&file=10700-10717 |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
| --- | --- | --- | --- | --- |
| A 1985 DWR study estimated safe yield as 625 AFY, assuming an average 43 inches of rainfall, but water years 2013 and 2014, the most recent years with comprehensive data, saw 24.15 and 22.26 inches of rain, respectively.<br><br>A study conducted by a private firm from 2002–2004 estimated safe yield to be between 259 and 283 AFY but did not specify the amount of rainfall that would yield these figures. | Local demand fell from 305 AFY in the 2001–2002 water year to 221 AFY in the 2011–2012 water year. | Because of the unique hydrogeology of the Mendocino Headlands, winter inflows discharge into the Pacific Ocean through porous rock formations, restricting the open aquifer system from storing water over an extended period of time. Water needs to be stored and captured just to be available through the end of the summer, preventing long-term recharge and reserves from being a feasible option for MCCSD. | Not Applicable | Not Applicable |

# Fox Canyon Groundwater Management Agency



# Fox Canyon Groundwater Management Agency

## Overview

| | |
|---|---|
| **County** | Ventura |
| **Area** | The Fox County Groundwater Management Agency (FCGMA): 183 sq mi[452] FGCMA consists of seven distinct basins. Area and population data are not currently available for each individual basin under the purview of the FCGMA. |
| **Population** | FCGMA: 0.7 million (2010)[453] |
| **CASGEM** | Medium-High, depending on basin: (by DWR basin designation) (Arroyo Santa Rosa Valley Basin – Medium); (Oxnard Sub-basin, Las Posas Valley Basin; Pleasant Valley Basin - High)[454] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Fox Canyon Groundwater Management Agency (FCGMA) is an independent Special Act District that manages and preserves groundwater resources in the southwestern portion of Ventura County "for agricultural, municipal, and industrial uses in the best interests of the public; and the common benefit of all water users."[455] FCGMA functions as an independent administrative district separate from the County of Ventura or any city government with the goal of managing the region's aquifers in conjunction with existing local entities. Agriculture is the dominant water user, but the aquifers within the FCGMA boundaries also supply more than half of the water needs for 0.7 million residents in the cities of Ventura, Oxnard, Port Hueneme, Camarillo, and Moorpark, plus the unincorporated communities of Saticoy, El Rio, Somis, Moorpark Home Acres, Nyeland Acres, Leisure Village, Point Mugu, and Montalvo.[456]

The agency boundary encompasses a northeast-southwest oriented, wedge-shaped area that widens in the west, and contains a total area of 183 sq mi. The Special District is bounded to the north by the Santa Clara River and South Mountain. Tertiary and Quaternary-age consolidated rocks north and east of the City of Moorpark define the boundary on the east. To the south, the Agency is bounded by the Bailey Fault and uplifted Santa Monica Mountains, while the Pacific Ocean coastline forms the western and southwestern limits of the Agency's boundaries.[457]

The distinct geographic and geologic characteristics of southern Ventura County created significant groundwater resources in the near-coastal and inland-valley portions of the District. The topography and geology of the area allow both surface runoff and percolating groundwater to flow toward the coastal Oxnard Plain, where such water can then percolate into sandy, alluvial aquifers that are bounded by impermeable clays and compacted silts.[458] The eastern portion of the FCGMA is comprised of narrow, steep-sided canyons that open into the broader east-west oriented Arroyo Santa Rosa, Las Posas, and Pleasant Valleys, while the western portion of the District consists largely of the broad, alluvial Oxnard Plain. The thickness of the collective usable aquifer zones beneath the Oxnard Plain typically exceeds 1,200 feet.[459]

Groundwater resources include both confined and unconfined aquifers within seven separate groundwater basins that lie either wholly or partially within the FCGMA (Arroyo Santa Rosa, East Las Posas, Oxnard Plain Forebay, Oxnard Plain, Pleasant Valley, South Las Posas, and West Las Posas), and each basin has its own unique physical, hydrogeologic and water quality characteristics. More extensive descriptions of each of these basin's physical characteristics can be found in the 2007 FCGMA Groundwater Management Plan.[460] Six named aquifers underlie the FCGMA boundary. In order from deepest to shallowest, these are: (1) Grimes Canyon aquifer, (2) Fox Canyon aquifer, (3) Hueneme aquifer, (4) Mugu aquifer, (5) Oxnard aquifer, and (6) perched or semi-perched zone.[461]

## Background to District Formation

Although early indigenous inhabitants of the region relied exclusively on surface water resources, by the early to mid-1800s, the first European settlers to the region started digging wells. Machine-drilled wells began replacing shallow, hand-dug wells in southern Ventura County by the 1880s.[462] During the first half of the twentieth century, the rapid development of lands for agricultural and urban uses, and droughts (1918 to 1934 and 1944 to 1977), led to a sharp spike in the rate of groundwater withdrawals. Seawater intrusion was first identified in the vicinity of Port Hueneme in the 1930s and was widespread across the coastal region by the 1940s.[463] At that time, groundwater levels in the Oxnard Plain Basin dropped below sea level, accelerating the rate of seawater intrusion. By the late 1950s, more than three dozen wells along the Pacific Coast in the area of Port Hueneme and Oxnard were rendered useless due to saline intrusion caused by overdraft. In addition to causing seawater intrusion, over-pumping also contributed to irreversible land subsidence in the region, ranging from 0.8 meters in the southern part of the Oxnard Plain to as much as 1.5 meters in the western Las Posas Valley Basin.[464]

Prior to the creation of the FCGMA, the California State Water Resources Control Board (SWRCB) directed the United Water Conservation District (UWCD) and the County of Ventura to develop a groundwater management plan (GMP) for the purpose of controlling extractions and balancing water supply and demand in both the Upper Aquifer System (UAS) and Lower Aquifer System (LAS) in what would later become the FCGMA.[465] These efforts ultimately proved unsuccessful. The continuing overdraft by groundwater users, and resulting saline intrusion into the aquifers beneath the Oxnard Plain led to the passage of the FCGMA Act, AB 2995, on September 13, 1982, which became effective January 1, 1983.[466] The goal of this legislation was to protect the Oxnard Plain from over-pumping by agricultural users and local water agencies by creating an independent agency to oversee and manage the region's aquifers in conjunction with existing local entities.

## Dates

**Creation of the Special District:** 1983
**Revisions or amendments:**
1991 – Senate Bill No. 747, Approved by Governor on June 10, 1991
2002 – All previous FCGMA ordinances are combined into a single Ordinance 8.0, along with updates and modifications to the management strategy
2004 – Assembly Bill No. 2734, Approved by Governor on August 23, 2004
2004 – All County Water Resources Division personnel along with the FCGMA staff are transferred to the newly reorganized County of Ventura Watershed Protection District[467]

## Special District Summary

FCGMA was established to manage and oversee Ventura County's groundwater resources, and all lands lying above the Fox Canyon aquifer fall under the purview of the FCGMA.[468] The FCGMA's 1982 enabling legislation, California State Assembly Bill, AB 2995, set up the means of administration and governmental powers of the Agency, including the adoption of ordinances.[469] It established the Agency's authority to perform groundwater management activities including, but not limited to, registering wells and other extraction facilities, regulating the construction of wells and other extraction facilities, initiating legal actions against the unreasonable use of groundwater resources, imposing operating regulations for groundwater extraction, regulating water transfers, and collecting fees for water withdrawals.

The FCGMA is funded through two main sources: management charges and groundwater extraction charges:

- **Management Charges:** Each of the four public stakeholder groups that appoints a representative to the Board of Directors initially contributed one-quarter of the District's total operating costs.
- **Groundwater Extraction Charges:** All well operators are required to self-report their annual groundwater withdrawals and are subject to extraction charges on a per acre-foot (AF) basis. AB 2995 stipulates that FCGMA may not charge more than $0.50/AF for groundwater extracted, but subsequent acts by the state legislature raised this cap, and in 2014, Resolution No. 2014-0 raised the charge to $6/AF.[470]

In addition, a Groundwater Sustainability Program fee of $4/AF (Resolution No. 2015-04) is also currently being assessed. This primary revenue stream for FCGMA is small and limits the Agency's ability to monitor the basins.[471]

Groundwater supplies from the Fox Canyon basins support Ventura County's agriculture industry and also provide some drinking water for the cities of Port Hueneme, Oxnard, Ventura, Camarillo, and Moorpark. Ventura County is one of the wealthiest counties in California, with a median household income (in 2014 dollars), 2010–2014 of $77,335.[472]

## Water Users

The bulk of groundwater under FCGMA's management is currently used for agricultural irrigation, as was the case since the early days of European settlement in the region. Though the proportion of water used for agricultural production dropped slightly over the past two decades, data for the 2014 water year indicate that approximately 71 percent of groundwater is currently used for agriculture, roughly 29 percent for municipal and industrial (M & I) purposes, with a remaining 0.4 percent classified as domestic.[473] These figures vary widely between basins, however, with agricultural production ranging from 100 percent in the Arroya Santa Rosa Basin to 40.4 percent in the more heavily urbanized Oxnard Plain Forebay Basin.[474] There are several classes of agricultural users, including: tenant farmers, absentee landowners including corporations who lease to tenant farmers, and farms that are owned and farmed by the same entity. Berries, row crops, citrus, and avocado are the dominant crops, and farms range in size from acres to hundreds of acres.

Groundwater under FCGMA's management also provides for more than half of the water needs for more than 0.7 million residents in the cities of Ventura, Oxnard, Port Hueneme, Camarillo, and Moorpark, and in unincorporated areas across southern Ventura County.[475]

Of the 690 self-reported active wells located within the FCGMA's boundaries, 468 wells were classified as agricultural, 131 were registered as M & I, and a further 91 wells were listed as domestic.[476]

## Management Structure

As outlined in its enabling legislation, the FCGMA is led by an elected, five-member Board of Directors, and staffed by technical and administrative personnel provided by the Ventura County Watershed Protection District.

The Board of Directors for the FCGMA is composed of one representative from each of the following four stakeholder groups:

- The Ventura County Board of Supervisors
- The United Water Conservation District (UWCD) Board of Directors
- The City Councils of the five incorporated cities that either wholly or partially overlie the Fox Canyon Aquifer. These include Ventura, Oxnard, Port Hueneme, Camarillo, and Moorpark.
- The seven[477] existing mutual water companies and special districts within the FCGMA, as identified in AB 2995. They include: (1) Alta Mutual Water Company, (2) Pleasant Valley County Water District, (3) Berylwood Mutual Water Company, (4) Calleguas Municipal Water District (CMWD), (5) Camrosa County Water District, (6) Zone Mutual Water Company, and (7) Del Norte Mutual Water Company.[478]

These four stakeholder groups select the fifth Board Member from a list of no fewer than five candidates nominated by the Ventura County Farm Bureau and the Ventura County Agricultural Association acting jointly. Five alternate Board members are selected according to the same criteria and serve only in the absence of the primary Board members.[479] Given the diverse interests drawing on groundwater under FCGMA's management, individual board members can be very influential in crafting board policy.[480]

Although the management structure of the FCGMA Board of Directors has not changed since the Agency's founding in 1983, the institutional structure of the Ventura County Water Resources Division was reorganized in 2004 to better coordinate accounting, funding and office resources between the FCGMA's administrative and technical support staff and personnel from the county's Water Resources Division.[481] This involved merging the former Water Resources and Development Department and the former Ventura County Flood Control District into the single, reorganized County of Ventura Watershed Protection District.

## Management Strategies

### Current Strategies

The FCGMA coordinates management of the basins under its purview with other local entities, sets pumping allocations, phased reductions, and water level and water quality criteria through its Groundwater Management Plan.[482]

*Cutbacks in withdrawals*

A stepped/phased-in goal of achieving 25 percent reductions in groundwater use by 2010 was initially established through several ordinances that were ultimately combined into the single Ordinance 8.0 in 2002. In 2014, in response to drought conditions, four specific groundwater allocation methods were implemented which include: Historical Allocation (HA) and Baseline Allocation (BA) for domestic users; Temporary Extraction Allocation (TEA) for municipal and industrial users; and Efficiency Allocation (Irrigation Allowance Index [IAI] method) for agricultural users.[483] The type of allocation depends upon the use of the groundwater, and the history of land and water use, as well as when the groundwater was extracted. Wells operated by Well Operators are grouped into three type categories: Agricultural (AG), Municipal & Industrial (M & I), and Domestic (DOM).[484] In addition to the agency's strategies, in December, 2015 Ventura County implemented a well-drilling moratorium.[485]

*Carryover credits*
A Conservation Credit Program was established to encourage cutbacks in pumping, along with a penalty system for exceeding the established annual allocation. The credit system allows well operators to vary their annual pumping, in response to changing climatic conditions, by allowing operators to roll over water savings from one year to be used in another. A more recent concern is that the historic credit system has resulted in a scenario where well operators currently hold credits equivalent to four years' worth of water withdrawals across the FCGMA's boundaries. At the end of 2014 these credits amounted to 716,398 AF compared to a total extraction rate of 149,715 AFY that same year.[486] The accrual and use of Conservation Credits is not allowed while Emergency Ordinance E is in effect. Furthermore, the Conservation Credit Program can be discontinued by the FCGMA Board of Directors.

**Management Strategies under Development**

There are several projects in various stages of development aimed at reducing water supply and quality problems within the FCGMA. Many of these projects are being carried out by other local entities, but are described in detail in the FCGMA 2007 Management Plan and in the 2013 and 2014 annual reports. These include the following:

- Building saltwater intrusion barrier wells
- Increasing the use of recycled waste water
- Pumping brackish water out of a shallow aquifer in the South Las Posas Basin to allow lower-salinity storm water to percolate into the aquifer[487]
- Construction of brackish and saline groundwater desalination facilities in the cities of Camarillo and Oxnard

**Potential Future Strategies**

Potential future strategies include the following:

- Creating a mechanism to better verify the accuracy of self-reported water extraction data
- Increasing the number and scope of basin-specific strategies for each of the basins under FCGMA jurisdiction
- Investing in additional storage projects
- Importing additional water[488]

## Monitoring and Reporting Requirements

In 1983, FCGMA Ordinance No. 1 required all well operators within its jurisdiction to register, pay extraction management fees, and begin reporting groundwater withdrawal data. Subsequent ordinances mandated flow meters on all wells (except for inactive and domestic wells [a single family residence on one acre or less with no income producing operations]),[489] with flowmeter accuracy verified every three years (per Amended Resolution 2008-04). All extraction facility (well) operators are required to report their groundwater extraction on a semi-annual basis using an Agency provided Semi-Annual Extraction Statement (SAES).

Importantly, groundwater extractions are self-reported to the FCGMA by the well owners or operators. Based on the groundwater extraction reported, each operator is required to calculate the extraction charge due, plus any surcharges, interest, or late penalties associated with their user account, and then remit payment to the FCGMA along with the completed SAES form. Fees are minimal, however, surcharges for extracting more than allocation are comparable to the cost of imported water, and as such are considered a disincentive to overpumping.

The FCGMA has collected extraction records for wells within its boundaries since 1985.[490] At the time of preparation of the 2014 annual report, 4 percent of the user accounts had not reported.[491] At the end of 2014, the FCGMA had 1,296 wells identified by State Well Numbers listed within its boundaries; of these, 690 wells were reported as active, 183 were listed as inactive, 415 wells destroyed, and 8 additional well numbers had been assigned to permanent monitoring.[492]

## Safe Yield

The original management plan for the FCGMA calculated basin (safe) yield for all seven basins within its jurisdiction to be 125,000 AFY.[493] Safe yield varies with climate and groundwater recharge conditions. Recently, during the drought with reduced groundwater recharge including subsurface inflow, this amount was revised downward to 100,000 AFY,[494] which would indicate that the volume of reported groundwater extractions was within approximately 2 to 7 percent of that the revised safe yield in 1995, 1996, 1998, 2001, and 2005. A benchmark of 125,000 AFY would indicate that safe yield was attained in roughly half of the past 25 water years (13/25 years).[495] Moreover, the FCGMA contains seven distinct groundwater basins within its boundaries, and does not establish specific safe yield values for each individual basin.

Rather than relying on safe yield values to assess whether the Agency is meeting its goals, the FCGMA sets annual basin management objectives (BMOs) for water levels and water quality in each of the basins and aquifers within its boundaries. Water level targets serve as the primary indicator for assessing whether the FCGMA has met its goals at each of its monitoring sites.[496] The FCGMA also prepares fall potentiometric surface maps for both the UAS and LAS.

## Groundwater Pumping and Overdraft

Groundwater production varies widely from year to year and is tied largely to the amount and patterns of rainfall. Comparisons of similar climatic years, such as 1990 and 2013 (both exceptionally dry), 1998 and 2005 (both exceptionally wet) or 2004 and 2008 (near average rainfall), reveals that while groundwater levels declined during dry periods, remained fairly steady during average periods, and rose during wet periods, overall reported pumping declined by nearly 30 percent during the first two decades of the FCGMA's existence.[497] The bulk of these declines came from reduced agricultural consumption, a trend the FCGMA largely attributes to the widespread adoption of higher-efficiency irrigation systems and to the conversion of agricultural land for urban uses.[498]

During this same time period, M & I pumping rates remained relatively flat. Unlike agricultural pumping, demand for M & I groundwater extraction is largely independent of annual precipitation rates within the FCGMA boundaries. However, these flat M & I pumping totals coincide with a significant increase in the total amount of urban acreage within FCGMA boundaries.[499]

An original goal of the FCGMA was to balance the rate of replenishment (supply) with the rate of extraction (demand) in the aquifers under the Agency's purview. Initial goals set in 1985 included balancing supply and demand in the Upper Aquifer System (UAS) by 2000 and in the Lower Aquifer System (LAS) by 2010.[500] These goals, and the FCGMA's overall purpose, remain unchanged to date.

Between fall 2013 and fall 2014, groundwater levels declined in the western half of the FCGMA. In the UAS, water levels in fall 2014 were below sea level in the Oxnard Plain Basin and most of the Oxnard Forebay and Pleasant Valley basins. In the LAS, water levels in fall 2014 were below sea level in the Oxnard Plain Basin and most of the Oxnard Forebay, Pleasant Valley, and West Las Posas basins.

Total reported groundwater extractions for 2014 (rainfall 71 percent of average) were the second highest reported since 1990,[501] only surpassed by reported extractions in 2013 (rainfall 25 percent of average). As of June 10, 2015, reported extractions for 2014 were 149,715 AF, a 20 percent increase above the 1991 to 2013 average reported groundwater extractions of 124,963 AFY. The extractions by user type and percent of 2014 total extractions are AG: 71 percent, M & I: 29 percent, and Domestic: 0.2 percent.[502] Of the 16 BMOs for water levels for the 2014 water year, none were met. This indicates that extraction has exceeded the rate of replenishment for every site monitored by the FCGMA within the most recent water year.[503]

## Water Quality

Saline intrusion is the most significant water quality challenge within FCGMA boundaries. Reducing seawater intrusion into the UAS was the primary reason behind the creation of the FCGMA.[504] However, seawater is not the only source of saline intrusion impacting the aquifer systems. Reduced pressure in the aquifers, a result of overpumping, also results in salts moving in from surrounding marine clays and older geologic units.[505] This form of saline intrusion is most notable in the Pleasant Valley Basin, but becomes less prominent closer to the coast, where seawater remains the only significant threat.

Other water quality concerns affecting the FCGMA basins and aquifers include high levels of chlorides, high levels of total dissolved solids (TDS) and nitrate contamination. While all seven basins have BMOs set for chloride levels, only two basins (Oxnard Plain Forebay and Las Posas) set targets for TDS, and only two (Oxnard Plain Forebay and Arroyo Santa Rosa) set targets for nitrates. Of the seven basins, Oxnard Plain Forebay is the most heavily urbanized and is the largest contributor to municipal water supplies of any basin under FCGMA jurisdiction.[506] In recent years, nitrate contamination has increased across the Oxnard Plain Forebay basin, while levels of TDS and chlorides have shown far greater variability over the past five years across the seven basins.[507]

## Disputes

As of 2014, no lawsuits had been filed against the FCGMA.[508] The FCGMA has often initiated litigation against firms and water companies for drilling illegal wells and exceeding allocation allowances. Settlements from such disputes constituted a significant portion of the FCGMA's revenue stream in FYs 2009/10 and 2011/12.[509]

## Discussion

Since the inception of the FCGMA, there have been significant declines in the rate of saline intrusion in many previously affected parts of the UAS, but conditions worsened in other parts of both the UAS and LAS. In the UAS portion of the Port Hueneme lobe, the most heavily threatened site at the time of the FCGMA's inception in 1983, a combination of pumping restrictions and an increase in recharge rates due to a new diversion system restored aquifer pressures and pushed seawater back toward the coast.[510] However, over the same time period, chloride concentrations rose and water levels dropped in the LAS portion of the Port Hueneme lobe.[511] Similarly, decreases in water quality and declining water levels characterized the Point Mugu area in the Pleasant Valley Basin, with increases in chloride concentrations from several hundred milligrams per liter (mg/L) to 4,600 mg/L in a little over a decade.[512] Taking into account annual rainfall fluctuations, there was a reduction in agricultural water use in the first two decades after the FCGMA's establishment, along with a per capita reduction in M & I consumption.

In recent years, low levels of rainfall, high rates of evapotranspiration, and increased demand from agricultural users resulted in the FCGMA missing all of its BMOs for water levels and 19 of its 34 BMOs for water quality[513] (see section on "Groundwater Pumping"). However, despite failing to meet these targets, the groundwater withdrawal rates measured in 2013 and 2014 remain lower than rates at the end of the 1986–1990 drought, even though the current rainfall deficit exceeds that found in 1990. Though this does suggest an increase in overall operational efficiency within the FCGMA boundaries, the current rates of withdrawal still exceed the rates of recharge across all seven basins, calling into question the long-term viability of these aquifers, given current production trends.

Although the FCGMA has enhanced authority as a Special Act District to manage its basin, disagreements between the diverse interests represented on the board have restricted the agency's ability to monitor agricultural withdrawals, and users self-reported these figures. Requirements under the 2014 Sustainable Groundwater Management Act are providing incentives to more closely monitor pumping in the basin. Significant progress has been made since 2014 by the Agency and stakeholders, working together to develop new basin specific allocation systems, management strategies, replenishment options that will lead to long-term sustainable groundwater use and management.[514]

## Analysis

1. The FGMA is using its authority under its enabling legislation and through subsequent ordinances to regulate groundwater extraction through the application of an annual allocation system and the assigning of credits as a potential incentive for non-use of allocations and/or for direct replenishment actions. Recent cutbacks for agricultural users have emphasized irrigating crops more efficiently rather than mandating cuts in net water extraction. Currently new basin specific allocation systems are being developed that will be linked to the sustainable/safe yield of each basin, sub-basin, or management area.

2. The future of the credit system also poses challenges. Although suspended temporarily, well operators currently hold almost five years' worth of water credits, which have no expiration date. Recent reports suggest that the use of even a small proportion of those credits in a given year could have dire consequences for water levels, water quality, and land subsidence across most of the aquifers within FCGMA jurisdiction. It is understood by the stakeholders that the Conservation Credit Program can be discontinued at the discretion of the Board of Directors.

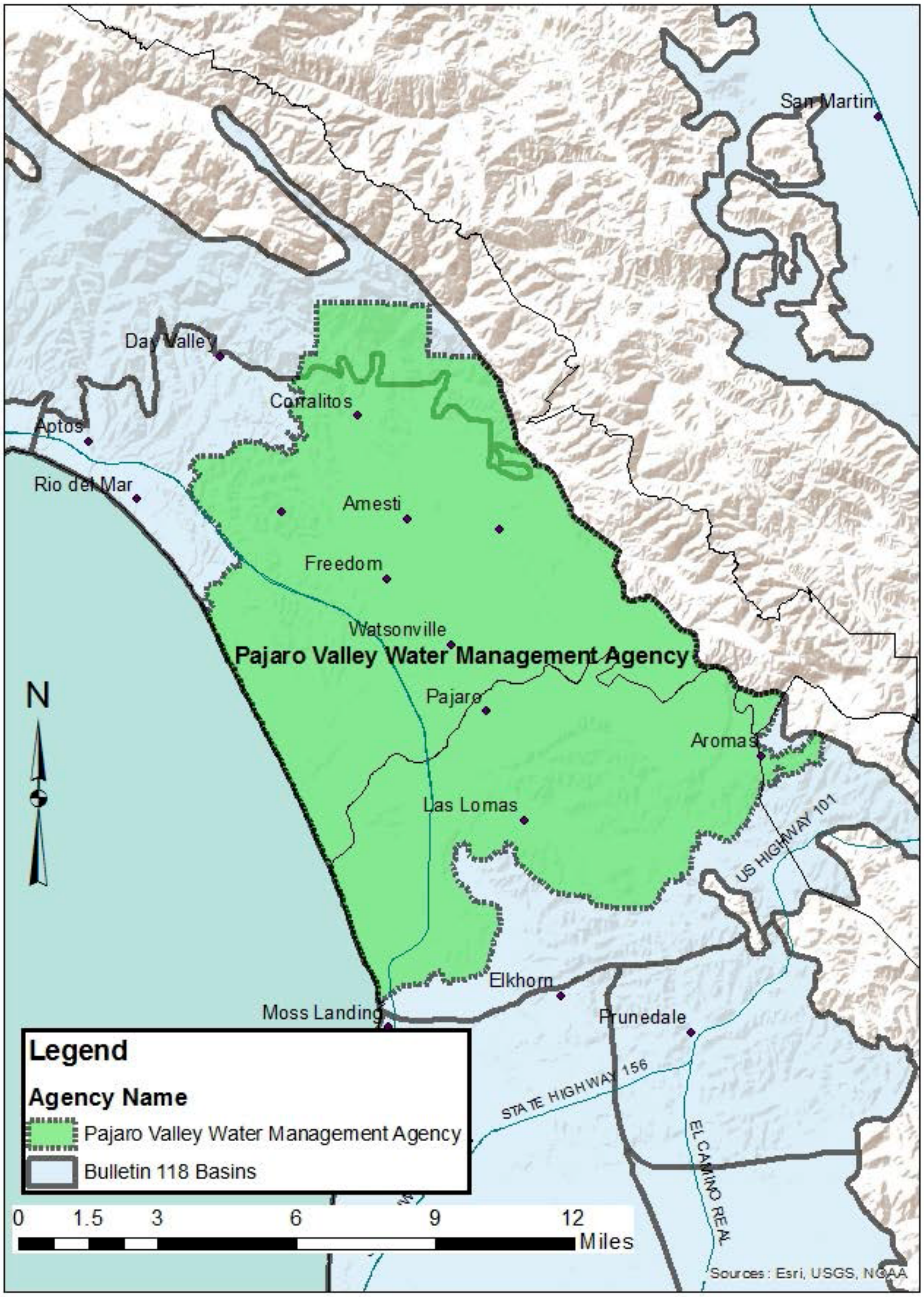
3. If the most recent safe yield figure of 100,000 AF (applicable during drought conditions) is applied, then there were only five years when reported extractions were within approximately 7 percent of that volume. The most recent water year (2015, the fifth year of below-average rainfall) saw the FCGMA miss every single BMO for water levels, and the prospects of

reducing extraction significantly enough to reduce groundwater declines appear challenging. However, working together with stakeholders in the basin, the agency is in the process of developing incentives to more closely monitor pumping in the basin, and progress has been made since 2014 to develop new basin-specific allocation systems, management strategies, and replenishment options aimed at the long-term sustainable groundwater use and management of groundwater.[515]

| Funding | Enabling Legislation |
|---|---|
| **FCGMA is funded through two main sources:**<br><br>**1. Management Charges:** Each of the four public stakeholder groups that appoints a representative to the Board of Directors initially contributed one-quarter of the District's total operating costs. The Board of Directors was only granted statutory authority to fix management charges for the first three years after the passage of enabling legislation, AB 2995.<br>**2. Groundwater Extraction Charges:** All well operators are required to report their annual groundwater withdrawals and are subject to extraction charges on a per-AF basis. This is currently the primary revenue stream for FCGMA**.**<br><br>AB 2995 stipulates that FCGMA may not charge more than $0.50/AF for groundwater extracted, but subsequent acts by the state legislature raised this cap, currently $6/AF.<br>See also: AB 2734 (2005):<br>http://www.fcgma.org/fcgma.old/publicdocuments/ordinances/ordinanceAB-2734.pdf<br>AND SB 988 (2014):<br>http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB988&search_keywords= | **Regulate pumping:** Yes<br>**Import water:** No<br>**Reclaim flood and storm water:** No<br>**Regulate water transfers:** Yes (only groundwater)<br>**Governing body: Stakeholder groups, including pre-existing public agencies whose representatives are elected, appoint members of the Board of Director**. The Board of Directors is composed of one representative from each stakeholder group:<br>1. The Ventura County Board of Supervisors<br>2. The United Water Conservation District (UWCD) Board of Directors<br>3. The City Councils of the five incorporated cities that wholly or partially overlie the Fox Canyon Aquifer (Ventura, Oxnard, Port Hueneme, Camarillo, and Moorpark).<br>4. The seven mutual water companies and special districts within the FCGMA, as identified in AB 2995.<br>These four stakeholder groups select the fifth Board Member from a list of at least five candidates nominated by the Ventura County Farm Bureau and the Ventura County Agricultural Association acting jointly.[516] Five alternate Board members are selected according to the same criteria.<br>**Enabling Legislation:** AB 2995:<br>http://www.fcgma.org/fcgma.old/publicdocuments/ordinances/ordinanceAB-2995.pdf |

| Safe Yield | Extractions | Trends | Overdraft Impacts |
|---|---|---|---|
| 2007:<br>125,000 AFY<br>2013:<br>100,000 AFY<br><br>Note: FCGMA is responsible for regulating groundwater extraction in seven basins that overlie/abut the Fox Canyon Aquifer. Safe yield figures are for all seven basins. Recent figures are not available for each basin on an individual basis. | 1990:<br>>178,000 AF<br>2013:<br>153,339 AF<br>2014:<br>149,715 AF<br><br>FCGMA requires all well operators, regardless of production capacity, to self-report their annual extraction totals. | Overall groundwater levels are lower now than when FCGMA first started regulating pumping in 1985, but levels have fluctuated over this time span, increasing in unusually wet years, and declining in moderate to dry rainfall years. Production dropped in the late 1990s to mid 2000s, only to rise again during the current drought. In general, in dry to moderate rainfall years, extraction rates exceed the rate of recharge.<br><br>Recent data indicate that current rates of extraction exceed the rate of recharge by about 50 percent. However, this is for all seven basins within the FCGMA service area. Not all basins have been affected equally, with the Santa Rosa Basin the least severely overdrafted, and the West Las Posas Basin and Oxnard Plain and Oxnard Forebay basins experiencing more serious water level declines. | Some areas that were affected by saline intrusion in the 1980s have improved. Other monitoring sites have seen increased levels of saline and TDS in recent years, especially since the start of the current drought.<br><br>In the most recent water year, FCGMA missed all 16 of its BMOs for water level, and missed 19 of its 34 BMOs for water quality, with saline intrusion the most pressing problem, followed by TDS and nitrates. |

# Pajaro Valley Water Management Agency



# Pajaro Valley Water Management Agency

## Overview

| | |
|---|---|
| County | Santa Cruz, Monterey and San Benito (the largest part of the Pajaro Valley Groundwater Basin underlies southeastern portions of Santa Cruz County)[517] |
| Area | Surface Area: 70,000 acres (110 sq mi)[518] |
| Population | 114,282[519] |
| CASGEM | High[520] |

CASGEM = California Statewide Groundwater Elevation Monitoring

There are three main watersheds located inside the Pajaro Valley Water Management Agency (PVWMA) boundaries: the Corralitos Creek Watershed, the Carneros Creek Watershed, and the Watsonville/Harkins Slough Complex. The entire Pajaro River Watershed extends east of the Agency into San Benito County and is 1,200 square miles in size. The area contributing to the flow in the Pajaro River is larger than all of the local watersheds combined.[521]

The boundaries of the Pajaro Valley Groundwater Basin (PVGB) include Monterey Bay on the west, and the San Andreas Fault, adjacent pre-Quaternary formations and the Santa Cruz Mountains on the east. The Basin's northern boundary consists of the surface expression of the geologic contact between the Quaternary alluvium of the Pajaro Valley and marine sedimentary deposits of the Pliocene Purisima Formation, while the Basin's southern boundary consists of a drainage divide in the Carneros Hills between Elkhorn Slough to the north and the Moro Cojo Slough, lower Salinas River Valley, and Salinas-Langely groundwater sub-basin to the south. The Pajaro River and its tributaries, Carneros Creek in the far southern portion of the PVGB, and a network of sloughs in the northwest, provide the primary drainage within the PVGB. Despite its relatively small geographic size, average annual precipitation totals vary widely across the Basin's surface area, ranging from about 15 inches near the coast to more than 40 inches over areas of the Santa Cruz Mountains that provide drainage for the PVGB.[522]

The PVGB contains several water-bearing geologic units, including the Purisima Formation, the Aromas Red Sands, Terrace and Pleistocene aeolian deposits, Quaternary alluvium, and dune deposits.[523] These are described below in order of age from youngest to oldest.

Alluvium in the PVGB is composed of Pleistocene Terrace deposits, which is overlain by Holocene age alluvium, which is overlain by largely unsaturated Holocene dune sands. The Terrace deposits in the Basin are comprised of unconsolidated basal gravel, sand, silt, and clay, while the overlying Holocene alluvium layer consists of sand, gravel, and clay deposited in the Pajaro River Valley floodplain. The basal gravel of the Pleistocene Terrace Deposits demonstrates strong hydraulic continuity with the underlying Aromas Red Sands Formation and is a major source of water for shallow wells in the Pajaro Valley floodplain.[524]

The deeper Aromas Red Sands Formation is the PVGB's primary water-bearing unit and is composed of friable, quartzose, well-sorted brown to red sands that are generally medium-grained and weakly cemented with iron oxide. This formation ranges in thickness from around 100 feet in the foothills to more than 900 feet below mean sea level near the mouth of the Pajaro River. Although this formation contains many of the most productive wells in the Basin, water-producing zones across the formation can vary greatly in their ability to transmit water.[525]

The Purisima Formation is the deepest and oldest water-bearing unit in the PVGB. Mostly marine in origin, it consists of thick sequences of highly variable sediments, ranging from extensive shale beds near its base to continental deposits in its upper portion. Its thickness varies from 1,000 to 2,000 feet in the central part of the Pajaro Valley to more than 4,000 feet in the lower area between the San Andreas and Zayante-Vergales Fault. Most sediments in this formation consist of poorly indurated, moderately permeable gravel, sands, silts, and clay. Hydrologically important outcrops to this formation are found along the north and east of the Pajaro Valley where this unit acts as a source of recharge to the PVGB.[526]

Two northwest-trending faults, the San Andreas and Zayante-Vergales Faults, serve as restrictive structures as they traverse the eastern portion of the PVGB. Impermeable volcanic rocks juxtaposed against the marine sediments to the east of the San Andreas act as a barrier to groundwater flow into or out of the PVGB. Relatively impermeable clays found in Elkhorn Slough form a barrier to north-south groundwater flows near the slough mouth.[527]

PVGB recharge occurs through direct percolation of rainfall, through streamflow seepage from the Pajaro River and its tributaries, and through irrigation return flows. Most recharge to the aquifers below the clay layers takes place in the eastern portion of the PVGB where clay layers are not laterally continuous. The Corralitos Creek watershed, in particular, possesses a high potential for recharge to the shallower aquifers due to a lack of clay layers in the sedimentary sequence. Coastal dune sand deposits also provide some recharge due to high permeability and the discontinuous confining layers at depth. A relatively well-defined confining unit underlies significant portions of the San Andreas Terrace, allowing for recharge. The reach of the Pajaro River extending from roughly Chittenden Gap to Murphy Crossing provides significant recharge to the underlying aquifers. The middle portion of the Pajaro Valley, on the other hand, contains the thickest confining clays, which trend roughly parallel to the Pajaro River.[528]

## Background to Special District Formation

Reliance on groundwater for irrigation was central to the development of agriculture in the Pajaro Valley beginning with Anglo settlement. Though many of the early settlers were able to meet basic irrigation and domestic needs through artesian wells that were once prevalent across many parts of the Pajaro Valley, the early to mid-twentieth century saw many of these springs run dry due to overproduction. In the 1940s growers began adapting deep well turbine pumps from the oil industry allowing them to switch to deeper wells to draw water from the underlying alluvium and other deeper water-bearing formations.[529]

Historically, groundwater levels were higher than today in inland areas. In places along the coast, some wells flowed artesian; and the pressure and seaward gradient of freshwater in the aquifer was able to prevent intrusion of seawater. By the 1940s, following the major development of groundwater resources to support a growing agricultural industry, some wells would still flow artesian, but only during winter. By the 1970s, water levels west of Watsonville were consistently below mean sea level from approximately May to December, often never recovering, providing the conditions necessary for seawater intrusion.[530]

The drought of the late 1970s sparked concern over water scarcity across much of California, prompting an increased focus on the state's groundwater basins. In 1980, the California Department of Water Resources (DWR) released Bulletin 118-80, which identified and defined 447 groundwater basins, sub-basins, and other areas of potential storage across the state. Most importantly, Bulletin 118-80 identified 11 groundwater basins that were believed to be in a state of severe overdraft at the time, with the PVGB ranking near the top of that list.[531]

Many community leaders at the time began to recognize that more coordinated management was needed to keep wells from running dry, which was a major challenge given that the lands overlying the PVGB fell under the jurisdiction of four distinct political entities: the City of Watsonville and the counties of Santa Cruz, Benito, and Monterey. An *ad hoc* group of local stakeholders, including many major agricultural operators began meeting regularly to develop goals for a locally controlled groundwater management agency and began to draft proposed legislation for the creation of such an entity. A local state senator spearheaded the initial legislation in Sacramento, while a voter ballot initiative formally approved the establishment of the PVWMA in 1984. The enabling legislation (Agency Act) has been updated several times since ratification.[532]

## Dates

**Creation of the Special District:** 1984[533]
**Revisions or amendments:** No significant amendments or revisions
**Other:**
1994 – The PVWMA completes its first comprehensive Basin Management Plan (BMP)
2002 – The PVWMA completes a revised BMP
2014 – The PVWMA adopts a BMP update, developed through a stakeholder driven process, which serves as the guiding document behind the Agency's goals and activities to this day

## Special District Summary

The Agency Act provides PVWMA with significant authority to manage the basin's groundwater. Section 102 of the PVWMA charter states: "Water resource management activities carried out under this Act in the public interest shall recognize the following objectives:

a. Local groundwater resources should be managed toward the avoidance and eventual prevention of conditions of long-term overdraft, land subsidence, and water quality degradation.

b. Local economies should be built and sustained on reliable, long-term supplies and not long-term overdraft as a source of water supply.

c. Water management programs should include reasonable measures to prevent further increases in the amount of long-term overdraft and to accomplish continuing reduction in long-term overdraft, realizing that an immediate reduction in long-term overdraft may cause severe economic loss and hardship."

It has the sole right to: store, recapture, distribute, and sell supplemental water in the groundwater basin, subject to conditions, and the right to enjoin unreasonable uses of water.[534] It can also:

- Regulate groundwater replenishment programs and recapture supplemental groundwater resulting from agency programs.[535] This is subject to certain requirements including that "property taxes shall not be used for payment" of costs, and agricultural uses shall have priority over other uses … within the constraints of state law."[536]
- Determine the amount of groundwater basin storage space available and allocate groundwater basin storage space within the groundwater basin after completion of a groundwater basin study.
- "Treat, inject, extract, or otherwise control water, including, but not limited to, control of extractions, and construction of wells and drainage facilities."[537] This includes the right to "regulate, limit, or suspend extractions from extraction facilities, the construction of new extraction facilities, the enlarging of existing facilities, or the reactivation of abandoned extraction facilities."[538]
- Document and manage water withdrawals from rural, agricultural wells, and impose spacing requirements on new extraction facility construction to minimize well interference.[539]
- Purchase and import water into the agency subject to limitations, but water can only be imported into the agency for agricultural purposes.[540]

While the PVWMA has the authority to broadly manage groundwater resources in the PVGB, it is not authorized to deliver potable water, and the PVWMA's activities have focused primarily on eliminating groundwater overdraft and halting seawater intrusion into the aquifer system.[541] This has been challenging, and groundwater levels have continued to drop with saline intrusion threatening agricultural wells further inland from Monterey Bay.

To address this impact, the agency has successfully brought in nearly $60 million in outside grant funds to help pay for the construction of nearly $100 million worth of water supply facilities, including the coastal distribution system that delivers non-potable water for irrigation through 20 miles of its coastal distribution pipeline.[542] This has helped to slow the rate of seawater intrusion, and water levels in 2015, while still below sea level, are higher when compared to the mid-1900s.

The Pajaro Valley is predominantly agricultural. Watsonville is the largest city with an estimated population in 2014 of 53,111. Median household income for city residents (in 2014 dollars) for the period 2010–2014, was $46,691 and the poverty rate was 20.6 percent.[543] There are approximately 28,300 acres of farmland within agency boundaries with a total crop value of approximately $814,000,000, making the land some of the most productive in the country.[544] While the total amount of irrigated acreage has remained relatively constant for the past several decades, the crop make-up has shifted, with a more significant share of agricultural land devoted to berries and row crops than was the case historically. Bushberry crops, including raspberries and blackberries, currently account for 17 percent of the total agricultural acreage, while strawberries account for more than 30 percent.[545]

## Water Users

The five-year average for total groundwater production for water years 2007–2011 was 53,000 acre-feet per year (AFY), but the 2013–2015 drought saw annual totals reach 60,000 AFY.[546] Overall, 84 percent of the groundwater production in the PVGB supplies agricultural irrigation, while municipal water purveyors and rural domestic well operators withdraw most of the remaining 16 percent.[547]

While the City of Watsonville is the largest municipal supplier in the PVGB, the Pajaro/Sunny Mesa Community Services District, and the Aromas District also supply municipal water to a smaller number of households and businesses.[548] The City of Watsonville has seen relatively flat levels of water use over the past two decades, despite modest increases in population.[549]

## Management Structure

A seven-member Board of Directors governs the PVWMA, with each member serving overlapping terms of four years each. All directors must live within the PVWMA boundaries and be registered voters. Four of the seven Directors are elected directly by registered voters living within PVWMA service area. Each elected representative serves a particular sub-area within the PVWMA service area rather than representing the agency at large. This means that each individual voter within PVWMA service area will only vote for one of the seven Board Members. The remaining three Directors are appointed by three political jurisdictions that overlie the PVGB: one representative is appointed by Santa Cruz County, one by Monterey County, and the third by the City of Watsonville. Appointed Directors serve two-year terms, rather than the four years served by elected representatives, and must earn at least 51percent of their net income from agriculture. Five of the seven current sitting Directors have terms ending later this year. There are no term limits restricting the number of terms any one Director can serve.[550]

## Management Strategies

The PVWMA recently updated its 2002 BMP by analyzing components of 44 different potential projects and five different management strategies, through a stakeholder-driven process.[551]

The 2014 revision includes the following seven major projects and components:

- Conservation Program
- Increased production and deliveries from existing facilities
- Increased Recycled Water Storage
- Harkins Slough Recharge Facility Upgrades
- Watsonville Slough with Recharge Basins
- College Lake with Inland Pipeline to the Coastal Distribution System
- Murphy Crossing with Recharge Basin

Further details can be found in the paragraphs below.

*The coastal distribution system (CDS)*

The CDS consists of nearly 20 miles of pipeline used to deliver blended recycled water and recovered Harkins Slough water for agricultural use. The project aims to deliver water to the coastal areas most severely affected by saline intrusion, ensuring a reliable water supply and reducing continued groundwater production from the wells most at risk from contamination. Portions of the CDS are still under construction in 2015, but a significant stretch of existing pipeline already provides water to over 2,000 acres of the most threatened irrigated coastal farmland within the PVWMA service area.[552]

*Recycled water*

Increasing the availability of recycled water for irrigation has been another primary management strategy that has gained traction in recent years. The current water reuse facility located within PVWMA boundaries emerged out of a partnership with the City of Watsonville to deliver recycled water into the CDS. After nearly a decade of multi-stakeholder negotiations, construction began on the Watsonville Recycled Water Facility in the early 2000s, and by April 2009, PVWMA began delivering tertiary treated, disinfected recycled water into the CDS to provide a supplemental source of irrigation for coastal farmland whose wells were threatened by saline intrusion. The supply meets Title 22 standards for recycled water, including tertiary treatment and (in this case) ultraviolet disinfection. This is required for use on edible food crops. The Watsonville Recycled Water Facility also provides a small amount of recycled water for non-potable municipal use within Watsonville city limits, but there are no other municipal users. The recycled water project also includes inland wells that are used to blend water to improve the quality for agricultural use and is currently capable of supplying up to 4,000 AFY of treated water for irrigation. Funding for the recycled water project included grants from state and federal sources.[553]

*The Harkins Slough Recharge and Recovery Facility*

The Harkins Slough Recharge and Recovery Facility, which has been in operation since 2002, diverts and filters excess wet weather flows from Harkins Slough to a 14-acre recharge basin located about a mile to the west. The diverted water permeates into the a surficial aquifer located within the terrace deposits where it serves to both recharge the groundwater basin and remain in storage until it is needed for agricultural use and can then be conveyed to growers via the CDS. The Harkins Slough Recharge and Recovery Project functions in tandem with the Watsonville Recycled Water Facility to provide water for irrigation in areas where the groundwater would otherwise be too saline for irrigation. The CDS is still being expanded to reach a wider swath of farmland in the coastal portion of the Pajaro Valley, but already is a primary source of water for over 2,000 acres of farmland within PVGMA boundaries.

Plans for additional recharge basins on the San Andreas Terrace (utilizing water from Watsonville Slough) and near Murphy Crossing (utilizing Pajaro River water) are in the planning stage, but have not been completed yet. Another project in the planning stage is the College Lake Project, which would convey surface water that naturally collects in the lake and send approximately 2,400 AFY to the CDS to enhance the supplemental irrigation supply. Taken together, the operational components of PVWMA's management strategy listed above (the CDS, the Watsonville Recycled Water Facility, and the Harkins Slough Recharge and Recovery Facility, and blend supplies) have the ability to produce about 7,150 AFY, which amounts to more than 10 percent of the total annual groundwater use that falls under PVWMA jurisdiction.[554] The use of the supplemental supply is to replace groundwater production at the coast and serve as in-lieu groundwater recharge. Modeling has shown that by reducing coastal groundwater production, a hydrostatic barrier will develop and impede the inland migration of seawater.

*Imported water*

Plans to import water from outside the PVGB, which comprises the fourth management strategy identified in the Revised BMP (2002), have not yet been implemented, and in a vote in 2010, the Board of Directors removed the import pipeline as a project in the 2002 Revised BMP.[555]

*Water conservation*

PVWMA had limited conservation program funding in the past due to a narrow reading of the Agency Act, which restricts the use of augmentation charge revenue to fund supplemental water projects. The decision by the Sixth Appellate District in *Griffith v. PVWMA*, discussed under disputes, clarified that the augmentation charge revenue may pay for activities required to prepare and implement the Agency's groundwater program, including water conservation. The PVGMA then developed its Cost of Service Study for a successful 2015 rate setting effort, and the study included water conservation measures to reduce pumping and improve the available water supply in a manner similar to other BMP projects. Conservation is now funded out of the Agency's special revenue fund.

The strategy to boost water conservation efforts among agricultural operators within PVWMA's service area was intensified with the assistance of recent grant awards. The voluntary program provides technical and financial assistance to participating growers over the course of multiple growing seasons to maximize grower adoption of more efficient water management practices. The conservation program includes grower workshops and training, and a high-level of engagement with local partners and stakeholders to define roles, streamline activities, and leverage resources in order to maximize basin-wide progress toward water conservation goals. Strategies include holding technical workshops to educate growers on how to use new tools and technology that rely on California Irrigation Management Information Systems (CIMIS) to collect data about water use for crops and evapotranspiration; offering rebates for irrigation system efficiency evaluations; and engaging in public outreach to ensure agricultural irrigators are aware of techniques for using water more efficiently.[556]

The conservation initiatives are not mandated, and farmers voluntarily adopt best practices in their irrigation techniques.[557]

## Monitoring and Reporting Requirements

PVWMA has state-mandated reporting requirements for groundwater extractions. Currently, wells that produce greater than 10 AFY are required to have a meter, which staff maintain, test, and read on a regular basis. Most ongoing monitoring activities conducted by PVWMA involve improving data collection capabilities to provide the agency with a clearer picture of groundwater production within its boundaries. PVWMA also focuses on engaging in public outreach efforts to educate the public about conservation techniques.

## Safe Yield

DWR Bulletin 118 estimates that total inflow into the PVGB averages around 61,000 AFY, but that figure includes saline intrusion near the coast and subsurface flow that is inaccessible to well operators. DWR estimates that under the pumping conditions that were present in the mid-2000s, the last time Bulletin 118 was updated, safe yield is approximately 24,000 AFY.[558]

In 2005 PVWMA joined with the United States Geological Survey (USGS) to develop the Pajaro Valley Hydrologic Model (PVHM), an integrated hydrologic flow model that uses MODFLOW-OWHM, a code that fully couples the simulation of the use and movement of water throughout the hydrologic system, and is used to help inform water resource management decisions. Earlier groundwater models showed that inflows and outflows from the landscape and streamflow networks to the groundwater flow system, combined with the sustained pumpage, led to the sustained storage depletion and coastal inflows that result in the overdraft conditions that have plagued the PVGB for decades. The groundwater levels below sea level due to overdraft conditions create a landward gradient causing seawater to intrude into the freshwater aquifer. Inland water levels equal to sea level are not sufficient to prevent intrusion because seawater is denser than fresh water and can still migrate inland even if water levels are equal. Seawater intrusion contaminates groundwater near the coast, resulting in increased groundwater salinity and a loss of fresh groundwater storage capacity.[559]

## Groundwater Pumping and Overdraft

The PVHM model, simulating changes in storage over time, showed that, prior to the 1984–1992 dry period, significant withdrawals from storage occurred only during drought years. Currently, groundwater levels persist below sea level all year long in some areas of the PVGB, while in fall, when water levels are typically at their lowest, roughly half the area of the basin has groundwater levels below sea level. Groundwater elevations through the central portion of the PVGMA service area range from 10 to 20 feet below sea level and have been dropping steadily since 1984. PVWMA estimates that long-term rates of saline intrusion average about 200 feet/year.[560]

Groundwater level trends were highly affected by the 1985–1992 drought. In March of 2000, 34 square miles of the 110 square mile basin had water levels below sea level. In September 2000, this area was 51 square miles (PVWMA 2001).[561] The 2013 annual report indicates that the basin remains in significant overdraft, with seawater intrusion and groundwater storage depletion occurring as a result.

From 2005–2015, water use in the Pajaro Valley averaged 55,000 AF. During the 2013–2015 drought, that number grew to over 60,000 AF, and it exceeded the 10-year average of 55,600 AF by 11 percent. It was the most water used since 2008 when usage was just over 62,600 AF, and only the second time since 1998, when accurate data from metering wells became available, that valley-wide water usage surpassed 60,000 AF.[562] Seawater is expected to continue to intrude into the freshwater aquifer until groundwater levels are restored or a hydrostatic barrier is developed. The decline in groundwater storage increases the risk of seawater intrusion during future drought cycles.

Since about 1993, growers in the Pajaro Valley have shifted to more water intensive crops, such as strawberries, bushberries, and vegetable row crops, as well as making additional rotational plantings. This has increased demand on limited groundwater resources. While the overdraft has varied seasonally and with changing climate, it is estimated to have averaged about 12,950 AFY over the past 43 water years. The completed CDS could be capable of delivering about 7,150 AF of water per year to coastal farms within the Pajaro Valley. This would represent about 15 percent of the 48,300 AF of average agricultural pumpage for the period 2005–2009. Combined with the potential capture and reuse of some of the return flows and tile-drain flows, the PVHM model authors predict that this could represent an almost 70 percent reduction of average overdraft for the entire valley and a large part of the coastal pumpage that induces seawater intrusion.[563]

## Water Quality

Seawater intrusion and its associated high chloride and nitrate levels are the most significant water quality threats facing the PVGB. During the past twenty years, the number of wells with excessive salt and chloride levels have increased due to continued seawater intrusion into the aquifer system. High levels of total dissolved solids (TDS) and other constituents affect groundwater in the Murphy Crossing area, while nitrate contamination is a problem in some areas, especially in places with high concentrations of residential septic tanks.[564] High nitrate concentrations have been measured at locations across the Pajaro Valley. DWR's (2004) sampling of 37 public supply wells across the PVGB found that one well out of 37 had high levels of pesticides, while nine wells of 37 had high levels of secondary organics.[565]

## Disputes

PVWMA has been involved in several notable lawsuits over the course of history. *PVWMA v. Amrhein*

(2007) involved a group of farmers who successfully sued the PVGMA over its increase in groundwater augmentation charge, which applies to all extractors of groundwater within the Agency's jurisdiction and is intended to fund additional water supply efforts. The court found that although the augmentation charge had been in place since 1994, the increase in charge was adopted in violation of Proposition 218, the statewide ballot initiative approved by the voters in 1996 that specifies the requirements for adopting "property-related" fees or charges, which the court found the augmentation charge to be. This case significantly curtailed the Agency's ability to use funds collected from groundwater augmentation charges. The *PVWMA v. Amrhein* decision declared that the augmentation charge is a "property related fee or charge" as defined in Proposition 218. The Agency refunded $11 million in over-collected fees over a three-year period.

In October of 2013, the Sixth District Court of Appeal in *Griffith v. PVWMA* issued a ruling affirming a Superior Court's 2012 decision validating a revised augmentation charge adopted by the PVWMA's Board of Directors in 2010. In a unanimous decision the three justice panel rejected the plaintiff's assertion that the augmentation charge was adopted in violation of Proposition 218, finding that because all groundwater users in the basin benefit from the Agency's groundwater management activities, not just the coastal users receiving supplemental water, the charges were a valid property-related fee or charge. In the decision, the Court of Appeal also found that the augmentation charge was expressly exempt from the fee/charge voting requirement under Proposition 218 because it is considered a water service. Based on this decision, the Agency conducted a successful rate setting effort in 2015 to provide revenues to implement the 2014 BMP Update projects and programs.

## Discussion

PVWMA has had mixed success in achieving the goals and targets outlined in its enabling legislation. Partnerships with the City of Watsonville to acquire recycled water and the ongoing Harkins Slough Recharge and Recovery project were successful in developing a recycled water supply and capturing, storing, and recovering surface water for later use an irrigation supply. The blended supplemental water supply available for irrigation in certain coastal areas where the well water is too salty to grow crops is used in-lieu of groundwater and directly reduces the amount of groundwater overdraft, which also impacts rates of seawater intrusion.

Overall groundwater production within the PVWMA's service area has spiked upwards in below-average precipitation years—the very years when groundwater recharge rates are at their lowest. However, even above-average precipitation years still see groundwater production exceed the rates of recharge, but in these years the deficit is more modest.

PVWMA is constrained by its enabling legislation and founding charter in terms of how it can use funds and fees. Moreover, more aggressive conservation practices and mandatory cutbacks that have been mandated in some other Special Districts have not been approved in the Pajaro Valley because they were deemed undesirable among stakeholders.[566] PVWMA's approach therefore is to provide additional supplemental supply at this time, rather than use a demand reduction strategy. Should additional supplies and conservation not reach the goal of achieving basin balance, demand reduction would need to be considered under the new state groundwater legislation.

## Analysis

1. PVWMA's stated primary goal for more than thirty years has been to reduce seawater intrusion. However current groundwater production remains nearly three times the rate of natural

recharge, and while analysis of the PVHM simulations does indicate that the magnitude of seawater intrusion has decreased, it has not stopped, and a significant trough below sea level still exists throughout the valley floor, centered around the Pajaro River channel.[567]

2. In an effort to reduce groundwater overdraft and seawater intrusion, the agency has successfully brought in nearly $60 million in outside grant funds to help pay for the construction of nearly $100 million worth of water supply facilities, including the coastal distribution system that delivers non-potable water for irrigation through 20 miles of its coastal distribution pipeline. This has helped to slow the rate of seawater intrusion, and water levels in 2015, while still below sea level, are higher when compared to the mid-1900s. Modest gains have also come from the availability of recycled water and the construction of new recharge ponds. PVWMA also increased spending to assist farmers with water conservation, and agriculture also began to institute field inspections and a system of electronic soil probes and wireless technology to deliver up-to-the-minute data on soil moisture.

3. In March 2016, the PVWMA Board of Directors approved an innovative Recharge Net Metering pilot program in conjunction with the University of California, Santa Cruz, and the Resource Conservation District of Santa Cruz County to incentive managed aquifer recharge. Funding for this program is approximately $100,000 per year for the next five years. The board is also considering a rotational land fallowing incentive program and has budgeted $200,000 for the upcoming fiscal year to support the program.

4. The Agency's 2014 BMP Update also defines future projects and programs to alleviate overdraft, including enhancement of existing projects, new surface water projects, and new recharge facilities. The completed CDS would be capable of delivering sufficient water to coastal farms within the Pajaro Valley, and combined with the potential capture and reuse of some of the return flows and tile-drain flows, hydrologic models suggest that this could represent an almost 80–90 percent reduction of average overdraft for the entire valley and a large part of the coastal pumpage that induces seawater intrusion. PVHM simulations indicate that the implementation of proposed BMP Phase I projects and programs will reduce groundwater overdraft by 80 percent and seawater intrusion by 90 percent by 2025.[568] If it is determined those objectives have not been met, Phase II projects will be implemented.

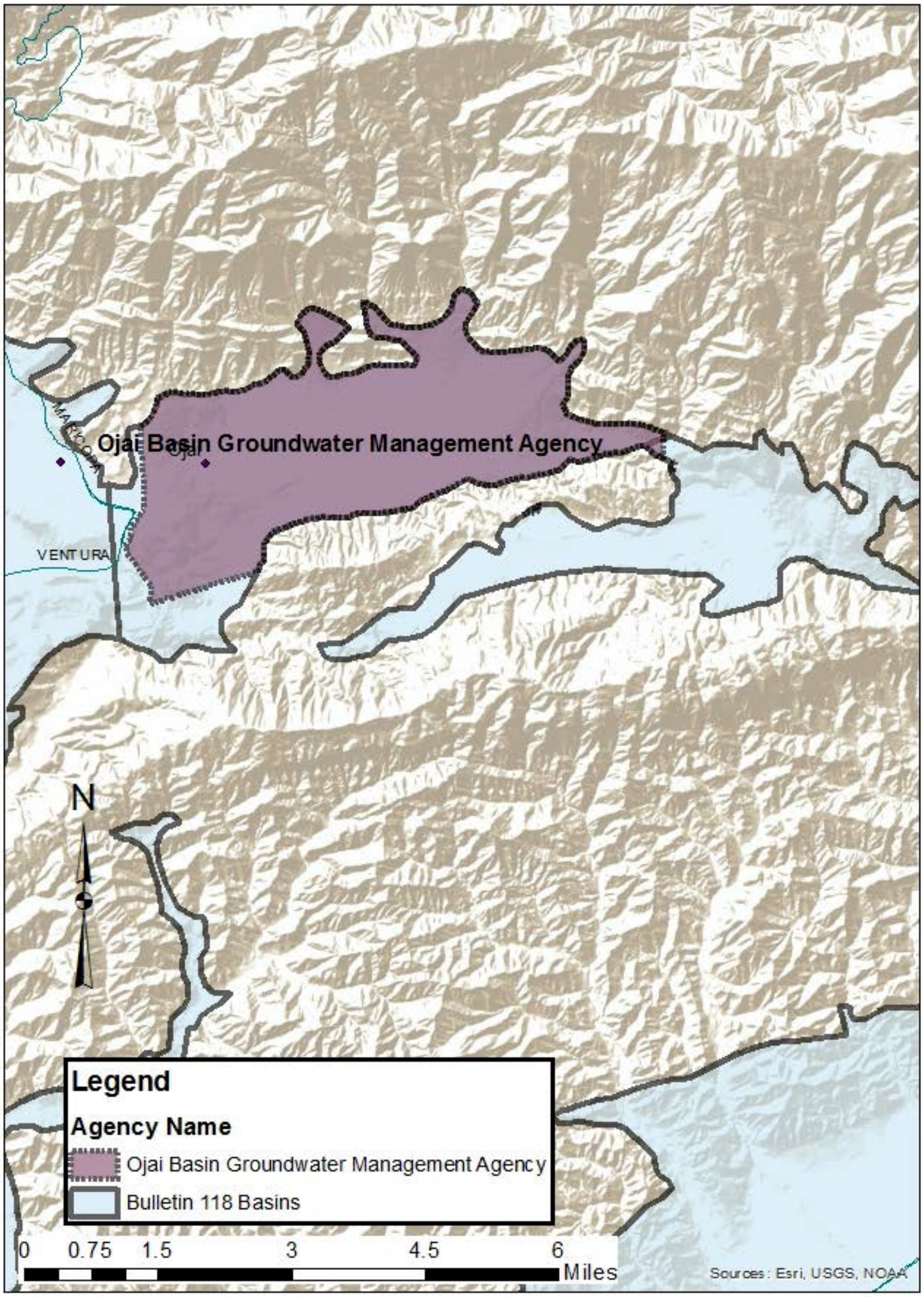
5. Note that if the valley did decide to import water from neighboring districts, the State Water Project (SWP), or the Central Valley Project (CVP), it would still face many of the same drought-related challenges faced by other districts in the state. Moreover, the PVMA, as a latecomer, would likely have a lower priority for receiving its allocation of imported water from the government projects in critically dry years, something that has already impacted many other districts that rely on imported water to meet local needs.

6. Many agricultural areas in the state rely significantly on imported water that will become less available and more expensive in the future. PVMA has an opportunity to provide examples of strategies to sustainably manage groundwater in an agricultural area without imported water.

| Funding | Enabling Legislation |
|---|---|
| **Funding is through the following revenue sources:**<br><br>**1. Management Fees:** These are collected on the county tax rolls, with current residential parcel fees of $18/year and commercial parcel fees of $20/year.<br><br>**2. Augmentation Charges:** These are collected from groundwater pumpers, with variable rates dependent on where in the basin one is located (pumpers in the coastal zone pay significantly more than in the less threatened inland areas). Augmentation charges are currently the most significant revenue stream for PVWMA, comprising about 80 percent of the annual budget.<br><br>**3. Delivered Water Charges:** These are levied on water users who consume recycled water through the Agency's recent greywater projects. Consumers of this water source are currently assessed a flat $348/AF, making this the second greatest revenue stream after the augmentation charges described above. | **Regulate pumping:** Yes (several specific provisions and restrictions apply, as per the District Act)<br>**Import water:** Yes (for agricultural use only – but the Agency does not currently import any water)<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body elected by all the voters or just property owners:** Four of the seven Directors **are elected by registered voters,** each representing a specific geographic subdivision of PVWMA service area. The remaining three Directors are appointed by Santa Cruz County, Monterey County, and the City of Watsonville, respectively.<br><br>For full text of the District Act, please see: http://www.pvwma.dst.ca.us/about-pvwma/assets/agency_act_assets/Agency%20Act%20-%202009_Act%20760.PVWMA.pdf<br>Section 2 of the District Act uses "should" rather than "shall" in defining many of the objectives of the District. |

| Safe Yield | Extractions | Trends | Overdraft Impacts |
|---|---|---|---|
| PVWMA does not list any figures for safe yield in any of its recent policy documents. | 53,000 AFY (The five-year average from 2007–2011)<br><br>More than 60,000 AFY (estimated water use during the peak of the 2013–2015 drought) | Water levels have declined overall since PVWMA's inception in 1984, and even in wet years, groundwater extraction typically exceeds the rate of recharge, But, while groundwater levels across the PVGB have remained in a state of decline for most of the past few decades, they are higher now than they were in the mid-1990s.<br><br>. | Groundwater levels are now 10–20 feet below sea level across much of the PVGB, and as a result many wells directly adjacent to the coast are now unusable, even for agriculture.<br><br>The agency's construction of a pipeline to deliver water to coastal stretches of farmland, along with other major efforts, have helped to slow the rate of seawater but not stopped it, and it is still continuing at the rate of 200 feet/year inland from the coast.<br><br>Nitrates are also a water quality concern in some regions of the basin.<br><br>Under future drought conditions with the basin in its current state, overdraft conditions could worsen and seawater intrusion rates could accelerate beyond what has been measured in the past.[569] The PVHM model author's predict that current plans for future deliveries from the CDS, combined with the potential capture and reuse of some of the return flows and tile-drain flows, could provide an almost 70 percent reduction of average overdraft for the entire valley and a large part of the coastal pumpage that induces seawater intrusion |

## Ojai Basin Groundwater Management Agency



# Ojai Basin Groundwater Management Agency

## Overview

| | |
|---|---|
| **County** | Ventura |
| **Area** | 10.7 sq mi[570] (Basin surface area) (DWR Bulletin 118 [2004])<br>10.1 sq mi (County of Ventura 2014 annual report)<br>9.2 sq mi (Ojai Basin Groundwater Management Agency [OBGMA] 2016)<br>16.4 sq mi (OBGMA's service area), greater than the surface area of the alluvial groundwater basin |
| **Population** | 8,258[571] |
| **CASGEM** | Medium[572] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Ojai Valley Groundwater Basin (OVGB) is located within the Ventura River watershed and underlies a portion of the Ojai Valley in Ventura County. The OVGB is a relatively deep, bowl-shaped basin that is bounded on the west and east by non-water-bearing tertiary age rocks, on the south by the Arroyo Parida - Santa Ana Fault and Black Mountain and to the north by the non-water-bearing sedimentary Tertiary age rocks of the Topatopa Mountains.[573] San Antonio Creek, a tributary to the Ventura River, drains the OVGB. Steep slopes in the tributary creeks to the OVGB (such as Horn Canyon and Senior Canyon) are responsible for forming extensive alluvial fan deposits as the fast-moving, debris-laden water slows, spreads out, and deposits suspended sediment[574] in increasingly finer gradation toward the valley center. The sand and gravel deposits, which are thickest in the northeastern portion of the OVGB, form its water-bearing aquifers and correlate throughout the basin between lacustrine aquitard materials. The OVGB is hydrologically separated from the adjacent (south) Upper OVGB by the exposed bedrock of Black Mountain, which does not fall under OBGMA purview.[575]

Alluvial groundwater is primarily found in Holocene- and Pleistocene-age alluvium; to a lesser extent groundwater is extracted from fractures, bedding planes, weathered portions, and remnant primary porosity of the underlying and surrounded older Tertiary sedimentary rocks. Groundwater in the OVGB is variable with respect to confinement; areas to the north and east are generally unconfined, while the deeper aquifers in the center and west and south of the basin are perennially confined. Shallow aquifers throughout the basin can be unconfined. Lithologies of the Holocene and Pleistocene alluvial deposits consist of sand, gravel, and clay. Holocene-age alluvium is composed of sediments ranging up to about 250 feet thick—comparable in geologic terms to those occurring in the underlying Pleistocene-age alluvium, which can range up to 650 feet thick. These alluvial deposits are the most productive units in the Basin, with well yields that range up to 600 gallons per minute (gpm) but can be highly variable depending on the degree of saturation and seasonal water level variability. The total combined thickness of both alluvium layers is as much as 900 feet in the center of the basin, where the most productive wells can be found. The underlying, older Tertiary-age weathered sediments are usually consolidated or cemented and typically yield minor amounts of poor quality water. Well yields from this unit typically range from 2 to 5 gpm, but may reach up to 250 gpm in isolated locales.[576]

Groundwater recharge occurs from the infiltration of precipitation through the valley floor, the percolation of surface waters through alluvial channels, especially in the northeastern portion of the Basin, and from water diverted into the San Antonio Creek spreading grounds. A smaller amount of groundwater recharge is also provided by irrigation return flow, anthropogenic return flow, and a minor amount of subsurface flow from bedrock systems.

The OVGB has the largest storage capacity of the Ventura River Watershed's four groundwater basins, with a maximum capacity of approximately 85,000 acre-feet (AF), and a safe annual year of approximately 5,026 AF.[577] Compared to many other groundwater basins in the state, the Ojai Valley Basin is quickly recharged during wet periods, and likewise is depleted relatively quickly during dry periods.[578] Long records of groundwater levels and storage correlate well to precipitation trends. Long-term spring high water levels indicate an average storage of 81 percent "full" over the period of record (1975–2015).[579]

## Background to District Formation

For the first century after the arrival of Anglo settlers, local groundwater resources from the OVGB were sufficient to meet local demand, both for agricultural irrigation and for residents of the town of Ojai. A five-year drought from 1987–1991 saw precipitous drops in groundwater levels across many wells in the Ojai Valley, prompting public outcry about the long-term viability of water from the Ojai Valley aquifers to meet the demand of Valley residents.

In 1990, proponents of an independent groundwater management agency began drafting legislation for the creation of a Special District, which ultimately passed the state legislature on October 8, 1991[580] via the Ojai Basin Groundwater Management Act. Much public commentary voiced support for the creation of the Ojai Basin Groundwater Management Agency (OBGMA), a special district to manage the OVGB's groundwater.[581] The City of Ojai, the Ojai Water Conservation District (primarily ranchers), Southern California Water Company (now Golden State Water Company), a consortium of local mutual water companies, and Casitas Municipal Water District (CMWD) provided the initial funding for the Special District's operations, as outlined in the enabling legislation,[582] and a representative of each now holds a seat on the OBGMA Board.[583] Fees levied for groundwater extraction provide ongoing funding for the Special District.

## Dates

**Creation of the Special District:** 1991
**Revisions or amendments:** No significant revisions or amendments
**Other dates**: NA

## Special District Summary:

OBGMA is responsible for managing and regulating groundwater withdrawals in the lightly populated OVGB area. The area managed by OBGMA has a total population of 8,257, and the City of Ojai had an estimated 2013 population of 7,581. As of the 2000 census, the median income for households in the city was $44,593, and 10.7 percent of the population were below the poverty line.[584] Agriculture is an integral part of life in Ojai's East End, and approximately 149 wells in the basin supply water to tree crops (mostly citrus and avocados), residents, and businesses in the City of Ojai and surrounding areas.

Agricultural demand accounts for about 60 percent of the water drawn from the basin, and urban demand accounts for about 40 percent.

OBGMA was created in 1991 amid concerns over groundwater in the Ojai Valley. The agency's stated goal is to ensure the protection of groundwater resources for the benefit of agricultural, municipal, and industrial water users of the Basin.[585] It collaborates closely with other existing water purveyors, municipal governments, and agricultural irrigators to develop and implement regulations for managing the Basin's groundwater. Unlike some Special Districts, OBGMA does not have specific responsibilities for distributing water or treating wastewater, but rather works in conjunction with other existing agencies to ensure these goals are met with a minimum level of disruption to the OVGB's resources.

OBGMA currently engages in a number of key activities to manage the Basin's groundwater resources, including: documenting groundwater extraction and reported pumping, collecting extraction charges from well operators, conducting groundwater management and planning, coordinating with Ventura County and private entities to monitor basin conditions, maintaining groundwater models of the basin, monitoring basin water levels, supporting the operation and maintenance of the San Antonio Spreading Grounds rehabilitation project, and participating in watershed, county, and state meetings.[586]

## Water Users

OBGMA estimates that approximately 40 percent of OVGB's water demand is for municipal use by residents of the City of Ojai, while the remaining 60 percent is for agricultural irrigation.[587] There are no separate figures available for domestic well operators that live outside the municipal service area.

There are three mutual water companies that exist separately from the Golden State Water Company, the City of Ojai's municipal supplier. Approximately 149 privately owned wells in the Basin supply water to tree crops—mostly citrus and avocados—which constitutes the primary source of agricultural water use in the Basin.[588]

The Ojai Valley has a mixed demographic profile, including both large-scale agricultural irrigators and affluent municipal consumers in the resort town of Ojai. Included among Ojai's municipal consumers are a range of entertainment industry celebrities and executives with large properties located within the District's service area, as well as a number of resorts and spiritual retreats.

## Management Structure

A five-member Board of Directors governs the OBGMA. Each Director represents an existing public agency or stakeholder group that has a longstanding interest in the Basin's groundwater resources. The five directors include: one representative from the City of Ojai, one representative from the CMWD, one representative from the Golden State Water Company, one representative from the Ojai Water Conservation District, and one representative elected to represent three mutual water companies: Senior Canyon Mutual Water Company, Siete Robles Mutual Water Company, and Hermitage Mutual Water Company.[589] The governing boards of each agency or group appoint the representatives, and the Board member representing the three mutual water companies is elected by a plurality of members from each of the three governing boards. Neither the enabling legislation, nor OBGMA's website specifies whether Board Members are appointed to fixed-length terms, or whether each participating agency appoints each Board member for a length of time based on organizational need.

## Management Strategies

OBGMA employs a variety of management strategies that involve regulating groundwater production, monitoring water levels, halting groundwater export outside the service area, and importing supplemental water from the CMWD to meet local demand and provide an additional source of groundwater recharge. These strategies were first elucidated in the 1994 Groundwater Management Plan (GMP) and updated and further clarified in the 2007 GMP, the most recent comprehensive plan for managing the Basin's groundwater resources.[590] They are: (1) understand the hydrology of the basin, (2) limit exports of groundwater out of the basin, (3) establish triggers to manage the Basin, (4) establish cooperative partnerships with other inter-basin agencies, and (5) obtain imported water.

*Collect hydrologic data, monitor and register wells*
The 2007 GMP states that OBGMA's first and primary management goal is to better understand the hydrologic conditions of the basin so that it can conduct management activities that are appropriate to the hydrologic changes that are taking place.[591] The OBGMA consequently engages in the following management strategies to achieve this goal: conducting routine monitoring of water entering and leaving the basin to develop more accurate hydrologic models of the Basin's groundwater conditions; expanding data collection capabilities by enhancing partnerships with Ventura County agencies and by cultivating relationships with private well operators to allow for the collection of more comprehensive datasets on groundwater conditions.

Initially, well operators were required to report their electrical power usage and their crop factor to the District to try to make the measurements as accurate as possible, but well metering requirements have been implemented gradually over the past few years. Currently, OBGMA conducts well registration activities in accordance with Ordinance 94-01 to ensure that all wells in the Basin are registered with the District; and that measuring of well extractions occurs with accuracy.[592]

*Control water exports*
The District's second major management goal is to protect and manage the Basin by controlling groundwater exports. The Agency's enabling legislation stipulates that no groundwater shall be exported from the Basin unless OBGMA grants a specific permit for this purpose. Because of the conditions of overdraft that prompted OBGMA's formation, the District has been extremely hesitant to allow for any kind of groundwater export. Based upon recent hydrologic circumstances, OBGMA has consistently found that no surplus water was available for export. Nevertheless, OBGMA conducts periodic reviews of groundwater conditions to determine if there is surplus water available, and, if so, it will consider issuing short-term export permits for water users further downstream who are located outside the Ojai Groundwater Basin drainage area (the Ventura River traverses multiple groundwater basins in Ventura County).[593]

*Establish trigger thresholds*
OBGMA establishes basin storage thresholds that, if exceeded, trigger special action by the District to assure the protection of groundwater supplies in the Basin. OBGMA develops the triggers and the conservation measures that must be implemented at these points, and will also develop the procedures and pass whatever ordinances necessary to put such conservation measures into effect.[594] The most recent round of mandatory conservation measures to be passed in accordance with this provision came in spring 2015 in response to the current drought.

*Collaborative inter-agency partnerships*
OBGMA's third major management goal is to encourage supportive activities in collaboration with existing public agencies and private well operators. Because each OBGMA Board member represents an existing agency or stakeholder group, the agency coordinates its action with these other agencies to increase the effectiveness of its management strategies.

Conservation
OGBMA works with the Golden State Water Company, the largest municipal supplier in the Basin, which has recently initiated its own conservation plan approved by the California Public Utilities Commission and supported by the City of Ojai.

Abandoned wells
OBGMA and Ventura County collaborate to address abandoned wells as part of the water well ordinance.

Artificial recharge
OBGMA is working with the Golden State Water Company, Ojai Water Conservation District, and Ventura County Watershed Protection District to augment the capacity for artificial recharge through the San Antonio Creek Spreading Grounds Rehabilitation Project (SACSGRP). San Antonio Creek was previously a major site of artificial recharge from the 1940s through the early 1980s, prior to OBGMA's formation, but was destroyed after the emergency construction of a debris basin following a fire in the watershed in 1985. Today the groups have collaborated to convert the SACSGRP area back into a site of artificial recharge.[595]

Imported water
An especially critical area where OBGMA works with other public agencies is through the import of surplus water from the CMWD. Each year agricultural irrigators import roughly 2,500–3,500 AF of Casitas water to irrigate their fields, which helps the ongoing conjunctive use of the native OVGB supplies with other watershed sources. Because many wells produce water most economically during periods of high (shallower) water levels, many pumpers find it more efficient to irrigate with Casitas water when water levels are lower. This strategy has limited groundwater level declines during several past drought cycles.[596]

*Increase organizational effectiveness*
OGBMA works to enhance communication with water users in the basin and increase administrative efficiency. To achieve these goals, OBGMA engages in a number of public awareness and outreach campaigns to increase public knowledge of water issues in the Basin. Additionally, OBGMA aims to keep costs as low as possible with only one part-time paid employee and annual operating costs that were $37,500/year in 2007 and less than $50,000/year today.[597]

## Monitoring and Reporting

Before OGBMA was established, municipal water purveyors and mutual water companies withdrawing groundwater from the OVGB monitored their withdrawals using meters. For the first two decades of OBGMA's existence, operators of existing wells estimated their extraction totals using a combination of electricity power usage and crop factors, while operators of low-yielding wells were exempt from these requirements.[598] OBGMA has gradually introduced more stringent monitoring and reporting requirements for private well operators located within its service area. Since the adoption of its first GMP, OBGMA has required all large-volume well operators to report their annual extraction totals and has required metering on all new wells.[599]

Ordinances during the past five years have mandated the retrofitting of many, but not all, older wells with water flow meters that are calibrated on a semi-annual basis, and have mandated semi-annual testing and calibration requirements for all water meters within the District service area. Recent ordinances have increased fines for non-compliance. A small number of metering exemptions remain for agricultural operators with wells that pre-date the formation of OBGMA, and that meet a number of specific conditions outlined in Ordinances 8, 9, and 10.[600] However, even these users are required to report estimated annual water use through a crop factors chart provided by OBGMA.[601]

## Safe Yield

The Ojai Basin has the largest capacity of the Ventura River Watershed's four groundwater basins, with a maximum storage capacity of approximately 85,000 AF and an annual average safe yield currently estimated at about 5,026 AFY.[602] However, this amount is heavily dependent on annual precipitation patterns and may be substantially less in critically dry years.

## Groundwater Pumping and Overdraft

Groundwater pumping averages in recent years have been roughly equivalent to the figures given for safe yield, both approximately 5,000 AFY. For the most recent three water years for which comprehensive data are available (2010, 2011, 2012) these figures amounted to 4,971 AF, 5,125 AF, and 5,310 AF, respectively. However, these figures do not include about 3,000 AF of CMWD water imported on-demand every year to help meet demand for agricultural irrigation. The total annual water use within the OBGMA service area is about 8,000 AFY, which is in excess of the average safe yield for the Basin.[603] Without the importation of Casitas water, groundwater production from just the Ojai Valley Basin exceeds the rate of natural recharge in below-average precipitation years, but the basin is quickly recharged during wet periods when recharge exceeds the rate of groundwater extraction. Declining water levels were observed during the 2012–2016 extended drought, prompting the implementation of more aggressive conservation measures and well monitoring ordinances.

## Water Quality

Recent annual reports published by OBGMA characterize water quality as generally suitable for domestic and agricultural purposes.[604] However, DWR's 2014 CASGEM report indicates that high levels of nitrates and sulfates are reported in the OVGB, though the CASGEM report does not indicate how widespread these impacts are.[605] According to OBGMA, average TDS across the Basin is about 812 milligrams per liter (mg/L), with concentrations ranging from 671 mg/L to 1,090 mg/L across various monitoring wells.

Depth-discrete information indicates higher chloride concentrations in deep aquifers in the central and southwestern portion of the Basin, while two wells have iron concentrations above the secondary maximum contaminant levels (MCL) for drinking water. OBGMA's 2012 annual report indicates that no inorganic chemicals were detected above the primary MCL for drinking water. Water chemistry shows high local variability across the OVGB, but comprehensive water quality data are not available for many privately operated wells in the District's service area.[606] Higher nitrates tend to be present in wells with shallow screened intervals or shallow to no sanitary seals near the east end of the basin. Higher chloride concentrations are more common in deep wells with deep screened intervals in the central and southwest portion of the basin.

## Disputes

There are no records of any previous significant lawsuits involving OBGMA. Minutes from a May 28, 2015, Board of Directors meeting stated that the Ojai Water Conservation District requested that OBGMA hire a water rights lawyer to review litigation in regards to *Santa Barbara Channelkeeper v. City of San Buenaventura et al.* Board members unanimously passed a decision to hire counsel to represent the OBGMA as a representative of the OVGB as a whole.[607]

## Discussion

Measures implemented by OBGMA over the past two decades have increased the agency's understanding of the relationships between precipitation, basin responses, storage, and extractions.

A major strategy to prevent groundwater overdraft is the conjunctive use of CMWD water in OBGMA's service area to help meet demand for irrigation.[608] However, even with the importation of water from the CUMD, groundwater supplies are tightly tied to precipitation, as the minimum natural recharge (approximately 2,000 AF during the driest years) is frequently less than the more stable extraction volumes. The basin storage capacity is relied upon to prevent overdraft, as is the reliance upon significantly wet years where basin recharge is approximately 10,000 AF. Pumping from the OVGB exceeding the rate of recharge in given below-average precipitation years (controlled overdraft) is also used to create available storage capacity to accept the natural recharge during wet years.

Measures and ordinances aimed at using water more efficiently have had some success in reducing aggregate demand for groundwater, with agricultural demand approximately 25 percent lower in 2012 than it was in the early 1990s with a similar amount of irrigated acreage.[609] OBGMA has also implemented more stringent monitoring and reporting requirements for agricultural operators than are found in adjacent groundwater basins along the Ventura River. These measures, and OVGB's additional conjunctive use and controlled overdraft strategies, have resulted in no groundwater overdraft during several years with below-average precipitation.

## Analysis

1. OBGMA implemented a range of range of regulations and policies governing the monitoring, reporting, and construction of wells during the first two decades of its existence. These measures continue to add to the understanding of the basin and assist in preventing groundwater overdraft.

2. The geologic conditions of the Ojai Valley allow water to percolate into underground aquifers at faster rates than in many other groundwater basins, but the same conditions contribute to faster rates of depletion in dry years. Annual pumping exceeds the rate of recharge in below average precipitation years, but it is also below rates of recharge in above-average precipitation years. Additionally, pumping from the OVGB is limited in below-average precipitation years, when water levels in some wells decline to the point where an alternative water source is required.[610] The net result is that the long-term average groundwater extraction has been in balance with the long-term recharge averages. Consistent with the historical record, groundwater levels did drop significantly during the 2012–2015 drought, with rates of pumping exceeding the rates of natural recharge.

3. On average, OBGMA water users consume about 5,000 AFY of local groundwater and 3,000 AFY of imported water, the latter going primarily to irrigate tree crops. The availability of imported water from the neighboring CMWD is crucial to ensuring this local demand is met. The imported water, combined with basin storage capacity and conservation measures, has enabled OVGB to sustain meeting water demand, and prevent irreversible water level declines, subsidence, significant water quality degradation, and habitat issues unrelated to drought. In June of each year, the OBGMA provides the amount water in storage from the preceding spring allowing pumpers to plan for their summer irrigation cycles and pruning/planting operations in concert with available water supplies.

4. The Ojai Valley has a mixed demographic profile, including both large-scale agricultural irrigators and middle-class residential water users in the City of Ojai and outlying unincorporated areas. Included among Ojai Valley residents are a range of incomes and lifestyles, including some large and small single properties located within the OBGMA jurisdiction, as well as a number of schools, nonprofit facilities, resorts, and spiritual retreats. Existing policies support groundwater and surface water use for irrigation and domestic uses.

| Funding | Enabling Legislation |
| --- | --- |
| **Enabling legislation SB 534 specifies three funding mechanisms the District may use:**<br><br>**1. Management charges to other pre-existing public agencies:** These charges apply to the various public agencies and stakeholder groups represented on the Board of Directors. These management charges were only intended to serve to provide start-up funds for the District and are no longer in place.<br><br>**2. Management charges for property owners:** These management charges are levied on a per/acre basis, with a higher rate for property owners whose entire holdings lie within District service area and a lower rate for property owners whose holdings straddle service area boundaries.<br><br>**3. Groundwater extraction charges:** These may be levied on private well operators on a per AF basis. | **Regulate pumping:** Yes<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body:**<br>Each Director represents an existing public agency or stakeholder group that has a longstanding interest in the Basin's groundwater resources. The five directors include one representative: from the City of Ojai, from the Casitas Municipal Water District, from the Golden State Water Company, and from the Ojai Water Conservation District; as well as one representative elected to represent three mutual water companies: Senior Canyon Mutual Water Company, Siete Robles Mutual Water Company, and Hermitage Mutual Water Company.[611]<br>**Representatives from each agency/stakeholder group are appointed by the respective governing boards of each agency or group, and in the case of the Board member representing the three mutual water companies, that person is elected by a plurality of members from each of the three governing boards.**<br><br>For further details, please see SB 534 (1991): http://www.obgma.com/15/pdf/OBGMA-Enabling-Act/SB_534.pdf |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
| --- | --- | --- | --- | --- |
| Safe yield = 5,026 AFY. This figure represents a current estimate of the long-term average safe yield. | Extractions = 5,000 AFY.<br><br>2010–2012 totals are equivalent to 4,971, 5,125, and 5,310 AFY, respectively.<br><br>If including extractions using 3,000 AFY of imported water from CMWD, primarily to irrigate tree crops, total demand = ~8,000 AFY. | Groundwater levels have remained relatively stable in recent decades, with a strong correlation of groundwater level fluctuations with rainfall patterns. | None | None |

# Mono County Tri-Valley Groundwater Management District

## Overview

| County | Mono (Special District boundaries); Mono and Inyo (boundaries of the Owens Valley Groundwater Basin, as defined by DWR)[612] |
|---|---|
| **Area** | Tri-Valley Groundwater Basin: 250 sq mi;[613] Owns Valley Groundwater Basin: 1,037 sq mi[614] (total surface area for the Owens Valley Groundwater Basin |
| **Population** | 954 people[615] living within Tri-Valley Groundwater Management District boundaries |
| **CASGEM** | Medium[616] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Benton, Hammil, and Chalfant Valleys form a northern extension of the Owens Valley.[617] These three valleys comprise a single watershed that is tributary to the Owens River and is bounded on the east by the White Mountains and on the west by the southeast sloping volcanic ash flows of the Volcanic Tablelands and the Benton Range. Runoff from the mountain ranges that bound the Tri-Valley eventually flows southward into the Owens Valley, with a small portion of runoff ultimately recharging the Owens Valley Groundwater Basin.[618]

The greater Owns Valley Groundwater Basin underlies Benton, Hammil, and Chalfant Valleys in Mono County and Round and Owens Valley in Inyo County. Of these, only the Mono County portion of the Basin falls under the purview of the Tri-Valley Groundwater Management District (TVGMD). This basin is bounded by non-water-bearing rocks of the Benton Range on the north, of the Coso Range on the south, of the Sierra Nevada on the west, and of the White Mountains and Inyo Mountains on the east. This system of valleys is drained by several creeks to the Owens River, flowing southward to the dry Owens Lake, a closed drainage depression in the southern part of the Owens Valley located outside Tri-Valley GMD boundaries. Water-bearing materials of the basin are sediments that fill the valley and reach at least 1,200 feet thick. The primary productive unit is Quaternary in age and divided into three distinct sub-units: upper, middle, and lower members.[619]

Because the basin consists of a series of deep basins with intervening bedrock blocks, the basin can be divided into three discrete hydrologic units—Tri Valley, Owens Valley, and Owens Lake—and groundwater studies have customarily treated these areas as separate water budget units. The upper member is composed of unconsolidated coarse alluvial fan material deposited along the margin of the basin, grading into layers of sand and silty clay of fluvial and lacustrine origin toward the basin's main axis. These strata are mantled and inter-bedded with basalt flows with an average thickness of 100 feet. The upper member is generally unconfined, except in small areas where it is confined locally by basalt layers. The middle member of the Owens Valley Groundwater Basin is composed of fine-grained fluvial and lacustrine material and some low-permeability volcanic layers. The middle member is usually a semi-confining layer, restricting vertical groundwater movement between the lower and upper layers, with an exception to this occurring underneath Bishop, where highly permeable pumice allows for some flow between all three members. The thickness of the middle member reaches up to 80 feet in some places near the axis of the basin, but is generally closer to 15 feet thick. The lower member is composed of Bishop Tuff, fluvial, and lacustrine material, as well as older alluvial fan deposits. The thickness of this member ranges from 30–40 feet along the edges of the basin to more than 500 feet near the main axis of the basin. The lower member is generally confined, except in areas near Bishop where the pumice layer allows for flow between all three members. Throughout the basin, confining layers pinch out toward the margin of the basin, and the three members coalesce into a single unconfined unit. East-west trending normal faults beneath the Poverty Hills serve as restrictive structures, limiting movement between different segments of the Owens Valley Groundwater Basin. In particular, this land formation reduces the speed and extent to which groundwater from the far northern parts of the basin can flow southward.[620]

Recharge is highly variable with precipitation and is between 220,200–271,300 acre-feet (AF). Previous hydrologic studies for Tri Valley and Owens Valley have treated the areas as separable groundwater units. The Los Angeles-Inyo Long-Term Water Agreement of 1991 currently governs most of the pumping in the Inyo County portion of the Owens Valley Groundwater Basin, and SGMA has identified the Tri Valley Groundwater Management Agency as the exclusive local agency with first rights to become the Groundwater Sustainability Agency for that portion of the basin.[621] Mono County provides demographic information on the Tri-Valley communities, but groundwater data are only available for the Owens Valley Basin as a whole. Groundwater has been developed for domestic, municipal, and agricultural uses, and to supply water to Los Angeles via the Los Angeles Aqueduct.[622]

## Background to District Formation

Information on the TVGMD is limited. California Water Code, Appendix 128-01 states that the TVGMD was created in 1989 and suggests that groundwater overdraft may have potentially been a problem at that point in time.[623] One Mono County government document suggests that previous concerns about the exportation of groundwater outside of the region may have been a contributing factor in leading to the creation of the Tri-Valley GMD.[624]

## Dates

**Creation of the Special District:** 1989
**Revisions or Amendments:** Not Available
**Other Significant Dates:** Not Available

## Water Users

There is no comprehensive publicly available data detailing groundwater users within the TVGMD's service area. However, demographic data on the region are available from Mono County, and some secondary sources, such as local media articles, do describe the types of irrigation that take place in the District. According to Mono County records from 2008, there were a total of 954 people living within the boundaries of the TVGMD, of whom an overwhelming majority relied on privately operated wells for domestic water use.[625]

Irrigated alfalfa production within the Tri-Valley region is estimated at approximately 4,000 AF, and limited to about a half-dozen major growers.[626] While the TVGMD's enabling legislation reserves three seats on the Board of Directors for large-scale commercial interests, it appears that these reserved

Board positions comprise roughly half of the large-scale growers within the TVGMD's service area. More than 70 percent of Tri-Valley residents who are active participants in the labor force work outside of Mono County altogether, with limited employment opportunities located in the area. Many residents commute daily to Bishop, located in Inyo County, which serves as the regional anchor for the region and serves as a center for commerce, health care, and employment for most Tri-Valley residents.[627]

## Management Structure

According to the enabling legislation, the TVGMD is to be governed by a seven-member Board of Directors. One Director is required to be a County Supervisor appointed by the Board of Supervisors; three Directors are required to be landowners who are elected registered voters living within the TVGMD's service area; and three Directors are required to be landowners who operate production facilities capable of producing more than 100 gallons per minute (gpm) exclusive of domestic use and also elected by registered voters living within the service area.[628]

The enabling legislation does not specify how long the Directors' terms are to be, but does indicate that the Directors may establish further procedural rules and regulations. Because fewer than 1,000 people live within the boundaries of the TVGMD's service area, the number of possible candidates eligible to fill certain roles on the Board of Directors is likely limited.

## Management Strategies

The TVGMD is a functioning public agency that holds periodic public meetings, but it has no permanent staffing, no employees on payroll, and does not maintain a functioning website. The government of Mono County makes occasional references to the Tri-Valley GMD in some of its own planning documents, but it appears that the scope of the district's activities are quite limited.

The enabling legislation grants the TVGMD broad-based authority to develop regulations and monitoring programs to ensure the supply of local groundwater for beneficial uses. Statutory powers granted by the legislation include: acquiring water and/or water rights within or outside the District, purchasing and importing water into the District, buying and selling water rights at rates determined by the Board, exchanging water and water rights, storing and recapturing water within the groundwater basin, imposing spacing requirements on new extraction facilities to minimize well interference, and developing mechanisms to prosecute the unreasonable use of basin groundwater.[629] The TVGMD also has statutory authority to regulate groundwater export by issuing permits once it determines that such export will not adversely affect other groundwater users in the basin,[630] though it is not clear whether and how the TVGMD exercises each of the powers outlined in the enabling legislation.

## Monitoring and Reporting

There do not appear to be any significant monitoring or reporting requirements for groundwater producers located within TVGMD boundaries. One 2010 Mono County newspaper article suggests that the TVGMD would be conducting limited groundwater elevation monitoring, but there is no further information available on whether or not these plans ever came to fruition, and there are no data available on specific groundwater levels in wells located within District boundaries.[631] One Mono County government document does mention that the District has ordinances governing the construction of new wells and the abandonment of old ones, but the specifics of these ordinances are not clear.[632]

## Safe Yield

The Tri-Valley region's water budget is the least well understood in the Owens Valley Groundwater Basin, and previous analyses have been limited by sparse hydrologic data in the region. Recharge from stream channel infiltration is not well known because only one of the fifteen streams on the west slope of the White Mountains is gauged; however, it is believed that stream channels are the predominant source of recharge, as is typical in the Mojave Desert and Great Basin groundwater systems.[633]

Under the Los Angeles-Inyo Long-Term Water Agreement of 1991, a trigger/threshold mechanism based on vegetation condition and effects of neighboring wells was established for the Owens Valley Groundwater Basin as a whole, instead of a basin wide safe yield.[634] Recent water budgets given in the conceptual model by Harrington are shown in Table 18. [635]

Table 18. Owens Valley Groundwater Basin Water Budget
(Based on water budgets for the Tri-Valley region, Owens Valley, and Owens Lake area)

| | Recharge | | Discharge |
|---|---|---|---|
| | | Pumping | ET, springs, seeps, baseflow |
| Tri Valley region | 17,000–43,000 | 16,200–19,600 | 5,000[1] |
| Owens Valley | 183,800 | 98,000[2] | 84,000 |
| Owens Lake | 29,500–55,000 | 2,300[3] | 51,400 |
| Subtotal | 230,800–281,900 | 116,500–119,900 | 141,400 |
| **Total** | **220,200–271,300[4]** | **251,900–260,300** | |

1. 4,400 acre-feet per year (AFY) groundwater discharge at Fish Slough plus 600 AFY discharge in Chalfant Valley.
2. 78,000 AFY pumping by LADWP plus 10,000 AFY by non-LADWP pumpers, plus 10,000 AFY from flowing wells.
3. Includes 2,000 AFY for irrigation and 300 AFY for water bottling plant.
4. 10,600 AFY was subtracted to account for overlap Owens Valley and Owens Lake study areas.

## Groundwater Pumping and Overdraft

There is some evidence to suggest that groundwater pumping has exceeded safe yield during the most recent drought years, but the available information is limited in scope and quality. A Sierra Wave article states that groundwater levels have dropped five to six feet in some places,[636] but relies on evidence from domestic well operators and a small number of commercial producers. Given that there do not appear to be any monitoring, metering, or reporting requirements for groundwater producers within TVGMD boundaries it is difficult to state with any strong degree of confidence the extent to which overdraft is present, and whether overdraft is merely a result of the current drought or whether overdraft is a persistent and ongoing challenge for the Tri-Valley region of Mono County.

## Water Quality

Private well operators located within the Mono County Tri-Valley Groundwater Management District service area are under no obligation to conduct water quality monitoring on their wells. There is no publicly operated distribution system of any kind, no wastewater treatment system, and no storm sewer system located within the District's service area, freeing the District of the statutory water quality monitoring requirements that apply to districts that maintain public supply systems. DWR characterizes water quality in the Owens Valley Groundwater Basin as good overall, with no distinct changes in quality over time. One Mono County government document characterizes county-wide groundwater quality as "good to excellent overall" with the only known area of groundwater contamination found in the Mono Basin, well to the north of, and hydrologically separate from, the Tri-Valley GMD service area.[637] Whether locally specific contamination exists in some privately operated wells remains unclear.

## Disputes

The TVGMD is seeking a redefinition of the basin's boundaries. The local newspaper reports on a January 2015 meeting where there was a discussion suggesting that a redefinition would enable the TVGMD to avoid the legal obligations associated with being classified as a medium-priority basin under the CASGEM. In an interview with a locally based media organization, TVGMD Board Member and commercial farmer Dave Doonan stated, "if we can prove we're separate from the Owens Basin, we could be classified as a low priority basin," which would "take the legislative pressure off."[638] The article also suggests that declines in groundwater levels are less pronounced in the Tri-Valley area of the Owens Basin than in many other groundwater basins in the state, and that there are few large-scale commercial irrigators in the area. The article points to concerns that as a medium-priority basin, growers could be required to install meters on their wells and there could be more stringent monitoring and reporting requirements than exist currently.[639] Recent modeling analysis however suggests that it is unlikely that TVGMD would become a low priority basin under CASGEM, but the District, along with Inyo and Mono counties, agreed that pursuing the basin division was still a good idea because of the hydrogeologic separation of the two sub-basins.[640] Inyo, Mono, and TVGMD have cooperated on the proposed basin boundary revision, and Inyo anticipates that to continue in the future regardless of whether the boundary revision is approved.[641]

## Discussion

There is no comprehensive website and a limited amount of public information available on the District's groundwater management strategies. There is a Tri-Valley URL that is hosted by the Mono County government that only lists an address where public meetings are held. There are currently no requirements for metering, monitoring, or reporting for private well operators located within the service area, and no public supply systems, nor any storm sewers or wastewater treatment systems located within the service area. Sanitation in the Tri-Valley region occurs solely through privately owned septic tanks and, given the sparse population of the region, there are very limited public services of any kind available to local residents. Moreover, more than 70 percent of Tri-Valley residents who are active participants in the labor force work outside of Mono County altogether, with very limited employment opportunities of any kind located in the area. Many residents commute daily to Bishop, located in Inyo County, which serves as the regional anchor for the region and serves as a center for commerce, health care, and employment for most Tri-Valley residents.[642]

## Analysis

- Though the Mono County TVGMD does exist as a functional political entity, there is very limited publicly available information on its activities compared to most other Special Districts in the state.

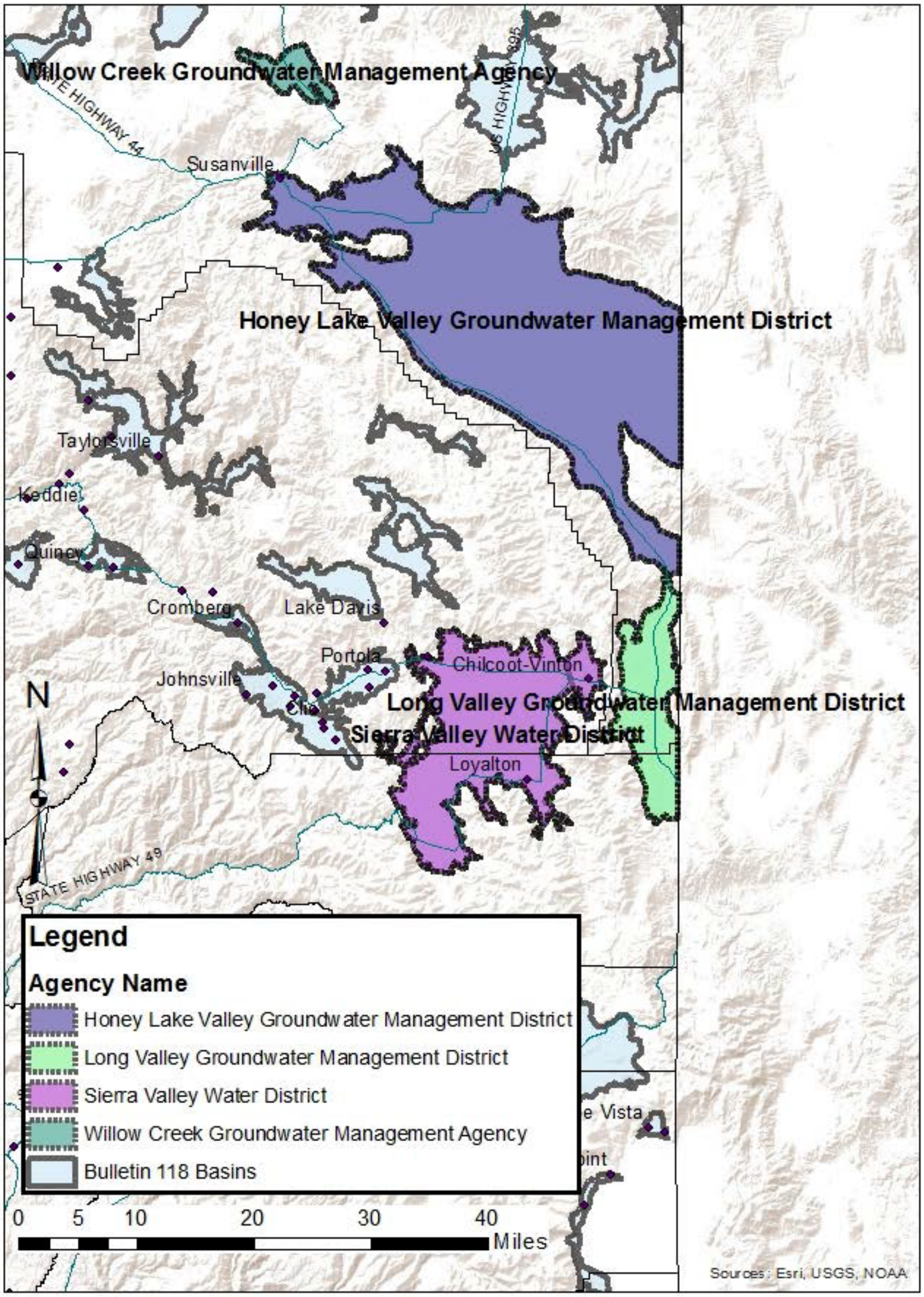
- There is a current discussion regarding basin boundaries for the purposes of complying with SGMA. Fish Slough Fault restricts and redirects flow from Hamill Valley toward Fish Slough, and public documents from the Inyo County Water Department suggest that new basin boundaries, if approved, would run directly beneath the Inyo County-Mono County line corresponding to the gravity anomaly indicative of shallow bedrock that obstructs the flow from Chalfant Valley to Owens Valley.[643] Though there is a provision under state law to revise groundwater basin boundaries for jurisdictional purposes, the outcome of this proposed measure will not be known until 2017, at the earliest.

- With a permanent population of less than 1,000 people, and with about 5 square miles of total land under irrigation, the share of Owens Valley Groundwater Basin's water that is used by Tri-Valley residents is small, and overall discharge appears to be less than recharge.

| Funding | Enabling Legislation |
| --- | --- |
| **This District does not maintain a website of any kind, and thus information on funding is quite limited.**<br><br>**Funding:**<br>**The enabling legislation merely states the following information about funding:**<br><br>**Sec. 801**. The board may use the Improvement Act of 1911 (Division 7 (commencing with Section 5000) of the Streets and Highways Code), the Municipal Improvement Act of 1913 (Division 12 (commencing with Section 10000) of the Streets and Highways Code), or the Revenue Bond Law of 1941 (Chapter 6 (commencing with Section 54300) of Part 1 of Division 2 of Title 5 of the Government Code) for the construction of any facilities authorized to be constructed by the District under this act.<br><br>http://codes.findlaw.com/ca/water-code-appendix/wca-sect-128-801.html | **Regulate pumping:** There is no specific provision in the enabling legislation that calls for across-the-board regulation of pumping. However, the Board of Directors may take action to prohibit and penalize "unreasonable use" of groundwater, and may impose spacing requirements for new well constructions.<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body:** Hybrid Board of Directors consisting of seven members – **six are elected, one is appointed**:<br>1. A county supervisor appointed by the board of supervisors.<br>2. Three residents of the District who are the owners of record of real property located within the District. These members shall be elected at large from the district.<br>3. Three residents of the District, elected at large, who are the owners of record of real property within the District with extraction facilities capable of pumping at least 100 gallons per minute exclusive of domestic use. Any member so elected may designate another person to sit on the board in place of the person so elected.<br>http://codes.findlaw.com/ca/water-code-appendix/wca-sect-128-401.html<br><br>**Enabling legislation** can be read on a section-by-section basis here: http://codes.findlaw.com/ca/water-code-appendix/#!tid=NA761175A734544BF840294AC981A04EB (see Ch. 128)<br><br>This section outlines specific powers granted to the Board of Directors: http://codes.findlaw.com/ca/water-code-appendix/wca-sect-128-702.html |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
| --- | --- | --- | --- | --- |
| Instead of safe yield, a trigger/threshold mechanism was established for the Owens Valley Groundwater Basin as a whole, based on vegetation condition and effects of neighboring wells. | For the Tri-Valley region,<br><br>Pumping:<br>16,200–19,600 AFY<br><br>Recharge:<br>17,000–43,000 AFY<br><br>Evapotranspiration, springs and seeps, base flow to water courses: 5,000 AFY | There is some evidence of overdraft during drought years, but information specific to Tri-Valley GMD's service area is limited. | N/A | N/A |

## Northeastern California Special Act Districts



# Honey Lake Valley Groundwater Management District

## Overview

| County | Lassen County (portions of the Honey Lake Valley Groundwater Basin underlie Washoe County, Nevada)[644] |
|---|---|
| **Total Basin Area**<br>**Total District Area** | 487.1 sq mi[645] (Groundwater Basin surface area); 2,400 sq mi[646] (Surface drainage area)<br>The Special District exists only on paper. Enabling legislation was passed in 1989, but the district was never formed (see sections below for further details). |
| **Population** | 23,566[647] |
| **CASGEM** | Low[648] |

CASGEM = California Statewide Groundwater Elevation Monitoring

Honey Lake Valley (HLV) is part of the Basin and Range geomorphic province that straddles the boundary between California and Nevada. The Valley is bounded to the north and northeast by Pliocene-Pleistocene basalt of Antelope Mountain, Shaffer Mountain, Amedee and Skedaddle Mountains, and the Modoc Plateau. On the southwest, the Valley is bounded by Mesozoic granitic rocks of the Diamond Mountains of the Sierra Nevada geomorphic province, while Bald Mountain protrudes through the Valley floor northwest of Honey Lake. More than 40 streams, most of which are intermittent, flow from the Diamond, Fort Sage, and Virginia Mountains into the HLV, with Honey Lake the most prominent surface feature in the basin. The lake fluctuates widely in terms of both surface area and volume, depending on annual precipitation totals. The California portion of the basin is about 45 miles long and varies in width from 10 to 15 miles, and is underlain by granitic bedrock at depths of 5,000 to 7,000 feet. The floor of HLV ranges in elevation from 4,000 feet mean sea level (MSL) near Honey Lake, to 4,200 feet MSL near the edge of the valley.[649]

Groundwater is found in Holocene sedimentary deposits, Pleistocene lake and near-shore deposits, and Pleistocene and Pliocene-Pleistocene volcanic rocks, which comprise the Honey Lake Groundwater Basin (HLGB) aquifer system. Holocene sedimentary deposits in the Basin consist of intermediate alluvium, alluvial fans, and basin deposits that partly fill the structural depression underlying HLV. Alluvial deposits contain poorly sorted silt, sand, and gravel that accumulate near the rim of the basin. The permeability of these deposits is moderate and due to their limited thickness, yield small amounts of water. The alluvial fans consist of poorly sorted deposits ranging in size from clay to boulders, with high permeability and a thickness up to 300 feet. These fans have limited areal extents along the southern portion of the basin and yield large amounts of confined and unconfined groundwater. The finer-grained basin deposits of the Holocene layer, which consist of poorly consolidated, bedded sand, silt, and clay, intercalated with the alluvial deposits, have low permeability, and are generally a poor source of water. Underlying the Holocene sedimentary deposits are Pliocene semi-consolidated sedimentary and pyroclastic deposits of tuffaceous silt, clay, diatomite, and sand. The thickness of these deposits is up to 4,500 feet and permeability is generally low.[650]

Pleistocene lake and near-shore deposits and Pliocene-Pleistocene and Pleistocene volcanic rocks compose the other major water-bearing units in the Honey Lake Valley Groundwater Basin (HLVGB). Lake and near-shore deposits are up to 700 feet thick and are found in the area adjacent to the northwest shore of Honey Lake where they are an important source of groundwater for local irrigation. Lake deposits to the east of Honey Lake consist mainly of silt and clay with low permeability and are a poor source of groundwater. Pliocene-Pleistocene and Pleistocene volcanic rocks consist of jointed volcanic flows of the Modoc Plateau and generally have scoriaceous tops and bottoms and dense interiors. This unit, found primarily along the northern and eastern edges of the Basin, has moderate to high permeability, and serves as an important confined aquifer for the far northeastern portions of the Basin. Lava flows in this area also serve as important recharge units.[651] Groundwater movement is largely controlled by topography in HLV, generally moving toward Honey Lake.[652]

Groundwater storage capacity to a depth of 750 feet has been estimated to be about 16,000,000 AF, however, much of this storage is not available for use due to water quality impairments, including total dissolved solids (TDS), trichloroethylene, nitrate, and arsenic.[653]

## Background to District Formation

Enabling legislation SB 1721 passed the California legislature on September 15, 1989, calling for the creation of an independent Special District to manage the groundwater resources of the HLVGB. Little information is available on the conditions leading up to the passage of SB 1721. Documents from the USGS suggest that groundwater levels were once in a state of decline in the Basin, but have since stabilized. Today the Basin has a CASGEM rating of “low” and is not considered a priority basin for further groundwater action.

## Dates

**Creation of the Special District:**
1989 – California legislature approved the creation of a Special District for managing the groundwater resources of the HLVGB. In the more than 25 years since the passage of AB 1721, there has been no functioning District.
**Revisions or Amendments:** None
**Other Significant Dates**:
1999 – Lassen County adopts Ordinance 539, adding Title 17 to the Lassen County Code prohibiting the export of groundwater out of the county without a permit.[654]

## Special District Summary

Identified as a priority groundwater basin, HLVGB is the source of water for agricultural activities and for the towns of Herlong, Doyle, Litchfield, Janesville, Milford, and Standish. It lies at the eastern edge of Lassen County and the western edge of Washoe County, Nevada. Agriculture is concentrated in the western and northwestern portions of the valley.

The California portion of the HLVGB is approximately 45 miles long and between 10 to 15 miles wide, and includes Lower Long Valley. The Nevada portion of HLVGB is approximately 9 miles wide, and between 11 and 5 miles long. Because the valley lies across state lines, it is the subject of water resource discussions between the two states, and groundwater exportation projects have been planned and proposed on the Nevada side of the basin.[655]

The enabling legislation specified that the District could assess and collect management fees from well operators located within the District service area. Groundwater extraction fees could also be levied on well operators on a per acre-foot (AF) basis. The Board of Directors was provided with the authority to decide whether these fees would apply to all well operators, or only apply to large-scale producers. The District was also enabled to regulate pumping, import water, reclaim flood and storm water, and regulate water transfers.[656]

## Water Users

Given the largely rural character of the HLV, many residents rely on wells for domestic use, and privately operated irrigation wells comprise the bulk of groundwater production in the basin.[657]

There are 2,086 domestic well records and 186 irrigation well records on file for HLV. Approximately 50 percent of domestic wells are shallower than 150 feet deep, and approximately 50 percent of irrigation wells are shallower than 350 feet deep. The majority of domestic wells are drilled to similar depth, indicating that adequate domestic supplies are readily available in HLV at depths between 100 and 200 feet. The irrigation well depths are not concentrated at one general depth, and instead irrigation wells have many different depths. Well yields vary throughout the valley, and irrigation wells are drilled deeper to secure an adequate yield in areas that are less productive.[658]

## Management Structure

Enabling legislation calls for the creation of a five-member Board of Directors, with four members elected at-large by large commercial well operators and the fifth member appointed by the Lassen County Board of Directors.[659] Eligible voters for the at-large candidates include landowners with more than 100 acres of land and who operate wells capable of extracting more than 100 gallons per minute (gpm), exclusive of domestic use. The proposed rules were never enacted, and the Special District exists on paper only.

## Management Strategies

In accordance with state law, Lassen County officials developed a Groundwater Management Plan (GMP) for managing the groundwater resources of Lassen County, which includes three distinct groundwater basins. However, there is no specific plan tailored to the HLVGB. Public agencies that overlie the basin; these include the City of Susanville, Susan Hills Mutual Water Company, Lake Forest Mutual Water Company, and County Service Area #2 – Johnstonville Water System. These agencies have legal obligations to protect the basin's groundwater reserves, but there is no single special district or other public agency currently responsible for protecting and managing the Basin as a whole.[660]

In 1999, Lassen County established groundwater management objectives with the passage of an Ordinance detailing requirements for the extraction and exportation of groundwater from Lassen County. Section 1, Title 17, Chapter 17.01 of the Lassen County Code states that the county "seeks to foster prudent water management practices to avoid significant adverse overdraft-related environmental, social, and economic impacts." The ordinance makes it unlawful to directly or indirectly extract groundwater underlying the county for use of that groundwater outside county boundaries without first obtaining a permit. The extraction of groundwater to replace a surface water supply to be transferred for use outside county boundaries is considered an indirect extraction of groundwater and requires a permit. A permit may only be granted if the Board of Supervisors determines that the extraction will not cause or increase an overdraft of the groundwater underlying the county, will not adversely affect the long-term ability for storage or transmission of groundwater within the aquifer, will not (together with other extractions) exceed the safe yield of the groundwater underlying the county and will not otherwise operate to the injury of the reasonable and beneficial uses of overlying groundwater users, or will not result in an injury to a water replenishment, storage, or restoration project operating in accordance with statutory authorization. Permits are valid for a term, set by the Board of Supervisors, not to exceed three "water years" for the date of issuance. No permit applications to extract and export water have been submitted to Lassen County since enactment of the ordinance. The permit does not grant any right or entitlement but rather the permit evidences that the health, welfare, and safety of the residents of the county will not be harmed by the extraction and exportation of groundwater outside the county boundaries. The permit in no way exempts, supersedes, or replaces any other provisions of federal, state, and district or local laws and regulations.[661]

## Monitoring and Reporting

Water quality monitoring in the HLVGB is currently conducted by other overlying agencies in Lassen County. The Susan Hills Mutual Water Company, Lake Forest Mutual Water Company, and County Service Area #2 – Johnstonville Water System all conducted water quality monitoring on wells that deliver water through their distribution systems, in accordance with state and federal law.[662] There are no monitoring or reporting requirements for private well operators in the HLV.

Groundwater quality monitoring is also conducted in Lassen County by DWR at a number of wells in Lassen County. DWR monitors 23 wells once each four years, and has monitored 24 other wells sporadically for water quality, including temperature, pH, total dissolved solids, metals, nitrogen compounds, dissolved potassium, sodium, calcium, magnesium, boron, and hardness. Groundwater quality data has been collected in 7 of 24 groundwater basins in Lassen County, including HLV.[663]

## Safe Yield

No figure for safe yield has been established for the Basin.

## Groundwater Pumping and Overdraft

In 2000, supply was approximately equal to demand in Lassen County. That year was an above-average year on the Sacramento River water index. Surface water is the primary source of supply for agriculture which generally occurs in the valley.[664]

Data on overdraft and groundwater pumping are not presently available for the Basin. One USGS document suggests that groundwater levels stabilized in the 1990s after a period of decline in the previous decade. There is also limited data publicly available as to whether groundwater levels have remained stable in the current drought. Subsidence has been observed in the area surrounding Amedee hot springs, where groundwater extraction for geothermal purposes is ongoing.[665]

## Water Quality

Although there is limited data available, groundwater quality in HLV is considered generally good, with some areas of concern. The most recent CASGEM report from DWR suggests that water quality concerns include high boron, arsenic, TDS, and nitrates in certain areas between Litchfield and Honey Lake. There exists some groundwater contamination from the Herlong Army Base, though the CASGEM does not specify the extent or kind of this contamination.[666]

## Disputes

There are no legal disputes associated with the basin. One potential area of concern is the export of groundwater from wells in Fish Springs Ranch to users in Washoe County, Nevada.[667]

## Discussion

There is no functioning special district for managing the basin's groundwater resources. The Valley is sparsely populated, and the basin received a "low" CASGEM priority rating

## Analysis

- While there is no special district management entity for the HLVGB, water management activities, including monitoring, are currently conducted by Lassen County and other public and private agencies that overlie the basin.

- In 1999, Lassen County passed an ordinance that makes it unlawful to directly or indirectly extract groundwater underlying the county for use of that groundwater outside county boundaries without first obtaining a permit. A permit may be granted if extraction will not cause or increase an overdraft of the groundwater underlying the county, will not adversely affect the long-term ability for storage or transmission of groundwater within the aquifer, will not (together with other extractions) exceed the safe yield of the groundwater underlying the county, and will not otherwise operate to the injury of the reasonable and beneficial uses of overlying groundwater users, or will not result in an injury to a water replenishment, storage, or restoration project operating in accordance with statutory authorization.

- Although Lassen County is very sparsely populated, neighboring Washoe County, Nevada, a portion of which overlies the HLV groundwater basin, has a rapidly growing urban population and serious water scarcity challenges. Managing the basin sustainably in the longer-term will require increased coordination between authorities on the California side of the basin and Washoe County officials.

| Funding | Enabling Legislation |
|---|---|
| **Though Enabling Legislation, SB 1721 (1989) passed the state legislature over 25 years ago, the approved District was never actually formed.**<br><br>**Funding Mechanisms:** Taken directly from the enabling legislation.<br>**1. Management Charges:** The District may assess and collect management charges from well operators located within the District service area. These charges may be fixed by the Board of Directors.<br>**2. Groundwater Extraction Charges:** These may be levied on well operators on a per AF basis. The Board of Directors has the authority to decide whether this will apply to all well operators, or whether it will only apply to large-scale producers. | **Regulate pumping:** Yes (SB 1721)<br>**Import water:** Yes (as per SB 1721)<br>**Reclaim flood and storm water:** Yes (as per SB 1721)<br>**Regulate water transfers:** Yes (as per SB 1721)<br>**Governing body:**<br>**Four** at-large Board of Directors to be **elected by all registered voters living within the service area.** The fifth Director is to be a representative from the County Board of Supervisors. Despite the enabling legislation having passed the legislature 27 years ago, no such Board has ever been formed.<br><br>For further details see SB 1721 (1989): http://clerk.lassencounty.org/Agenda/MG59475/AS59528/AS59534/AI59556/DO59604/1.PDF |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
|---|---|---|---|---|
| The HLVGB is recharged by the Long Valley Creek, outflow from the adjacent Long Valley Groundwater Basin, and about 14,000 AFY of agricultural irrigation runoff that percolates down into the aquifer.<br><br>More specific figures for safe yield are not publicly available. | 1997: 70,000 AFY (According to a survey of water users in the HLV, 51,000 AF involved agricultural irrigation, while the remainder comprised industrial and municipal uses). The region does not import any water. | Groundwater levels dropped in the late 1980s and early 1990s, only to recover to pre-1990s levels by 2004. In 2000, supply was approximately equal to demand in Lassen County, but no figures are available for Honey Lake Valley Groundwater Basin. | NA | NA |

# Long Valley Groundwater Management District

## Overview

| | |
|---|---|
| **County** | Lassen, Sierra Counties, California; Washoe County, Nevada[668] |
| **Total Basin Area** | Total Basin Area: 73 sq mi[669] |
| **Population** | 46,836 (including areas of Nevada overlying the basin)[670] |
| **CASGEM** | Very Low[671] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Long Valley Groundwater Basin (LVGB) is an elongated north-south trending basin located at the western edge of the Basin and Range Geomorphic Province. The LVGB is bounded by Peavine Peak to the south, Peterson Mountain to the east, Mesozoic granite rocks of the Diamond Mountains to the west, and the Honey Lake Valley Groundwater Basin (HLVGB) to the north.

Two east-dipping normal faults are inferred to lie along the central and western parts of the valley. These include the Diamond Mountain Fault and a second, central unnamed fault that extends from Peavine Peak through Reno Junction. The valley is generally an asymmetric half-graben development, with valley sequences tilting westward.

South of Highway 70, between the Diamond Mountains and the central Long Valley Fault, the LVGB is characterized by shallow bedrock at an average depth of 150 to 300 feet. Pleistocene non-marine sedimentary rocks comprise valley fill in this region of the LVGB. These older valley fill underlie terraces along the west side of the valley. East of the central Long Valley Fault the valley is underlain by a thick, west-dipping Pliocene non-marine sequence referred to as the Hallelujah Formation. This sequence thins to a few hundred feet in the vicinity of Bordertown and forms a north-trending anticline between Cold Springs Valley and the southernmost part of Long Valley.

Long Valley Creek, an adjudicated stream, flows through the Basin and discharges into the HLVGB. The major sources of groundwater recharge in Long Valley are considered to be direct recharge from rainfall and through percolation of Long Valley Creek and its tributaries. There is some restriction of flow between the HLVGB and LVGB, due to the presence of shallow bedrock at the northern end of the valley. Long Valley is also hydrologically connected to Cold Spring Valley to the south. Depending on precipitation totals, Cold Spring Valley receives an estimated 200 to 500 acre-feet (AF) of annual underflow from Long Valley.[672]

Long Valley is underlain by fluvial, Quaternary sediments and Tertiary fluvial-lacustrine sediments. The Pliocene Tertiary sediments are the primary water-bearing formation for the valley, which comprise the Hallelujah Formation, whose total thickness likely ranges from 3,000 to 8,000 feet.

Beds of sandy pebble and cobble conglomerate mark the lower part of the formation. These deposits supply water to most of the wells located along the southern part of the valley. The total storage capacity for the LVGB is estimated to be somewhere between 180,000 and 300,000 AF.

The LVGB is near Reno, and it is an interstate basin, sharing a watershed with Washoe County, Nevada.[673]

## Background to District Formation

In 1980, the legislature passed the Sierra Valley Groundwater Basin Act of 1980,[674] authorizing the Boards of Lassen and Sierra Counties to exercise a Joint Powers Agreement (JPA) for purposes of groundwater management with respect to the Long Valley Basin. The JPA was adopted in 1985, creating the Long Valley Groundwater Management District (LVGMD).[675] The legislature's declaration of purpose recognized that "preservation of the groundwater within Long Valley for the protection of agricultural and other resources is in the public interest and that the creation of a district pursuant to this Act is for the common benefit of the Sierra Valley water users."[676] The Act authorized the formation of two independent Special Districts to manage the groundwater resources of the LVGB and the nearby Sierra Valley Groundwater Basin (SVGB), respectively.[677] The legislation was a response to the drilling of large wells on the Nevada side of Long Valley near Bordertown and concern that the LVGB would be overdrafted.[678]

## Dates

**Creation of the Special District:** January 28, 1980 – This is the date that the California legislature approved the creation of a Special District for managing the groundwater resources of the LVGB.
**Revisions or Amendments:** None
**Other**:
1985 – Adoption of the JPA between Sierra and Lassen Counties creating the LVGMD.[679]
1999 – Lassen County adopts Ordinance 539, adding Title 17 to the Lassen County Code prohibiting the export of groundwater out of the county without a permit.[680]

## Water Users

Given the largely rural character of the Long Valley, many residents rely on wells for domestic use, while privately operated irrigation wells comprise the bulk of groundwater production in the LVGB. Recent figures for groundwater extraction rates are not available. However, California Department of Water Resources (DWR) studies from the 1980s estimate total annual groundwater production to be 102 acre-feet per year (AFY), of which agricultural use comprises 74 AFY, while municipal and industrial uses comprise 28 AFY.[681] There are 33 domestic well records on file, and no irrigation well records on file for Long Valley. Approximately 50 percent of domestic wells are shallower than 150 feet deep.[682]

## Management Structure

The LVGMD Board was originally comprised of five members. Two additional members were added in 1987. Pursuant to the JPA, two LVGMD Board members are members of the Lassen County Board of Supervisors, one is a resident of Sierra County and the last, appointed by the LVGMD, is a resident of either county.[683] The Board does not have regularly scheduled meetings.

## Management Strategies

In 1999, Lassen County passed Ordinance 539, adding Title 17 to the Lassen County Code detailing requirements for groundwater extraction and requiring a permit for exportation of groundwater outside the county. Section 1, Title 17, Chapter 17.01 of the Lassen County Code states that the county "seeks to foster prudent water management practices to avoid significant adverse overdraft-related environmental, social, and economic impacts." The ordinance makes it unlawful to directly or indirectly extract groundwater underlying the county for use of that groundwater outside county boundaries without first obtaining a permit. The extraction of groundwater to replace a surface water supply to be transferred for use outside county boundaries is considered an indirect extraction of groundwater and requires a permit.[684]

A permit may only be granted if the Board of Supervisors determines that the extraction will not cause or increase an overdraft of the groundwater underlying the county, will not adversely affect the long-term ability for storage or transmission of groundwater within the aquifer, will not (together with other extractions) exceed the safe yield of the groundwater underlying the county and will not otherwise operate to the injury of the reasonable and beneficial uses of overlying groundwater users, or will not result in an injury to a water replenishment, storage, or restoration project operating in accordance with statutory authorization. Permits are valid for a term, set by the Board of Supervisors, not to exceed three "water years" for the date of issuance. No permit applications to extract and export water have been submitted to Lassen County since enactment of the ordinance. The permit does not grant any right or entitlement but rather the permit evidences that the health, welfare, and safety of the residents of the county will not be harmed by the extraction and exportation of groundwater outside the county boundaries. The permit in no way exempts, supersedes, or replaces any other provisions of federal, state, and district or local laws and regulations.[685]

In accordance with state law, Lassen and Sierra County officials have also developed Groundwater Management Plans (GMPs) for managing the groundwater resources. Lassen County's GMP follows the California Water Code (CWC) Sections 107450 et seq., by using plan components to support groundwater management objectives which in turn meet a countywide groundwater management goal. The GWMP contains the required components from Senate Bill 1938, the voluntary components from Assembly Bill 3030, and contains suggested components from DWR Bulletin 118-2003.[686]

## Safe Yield

Current figures for safe yield for the Basin are not presently available. A DWR report from the 1980s estimated perennial (safe) yield for the Basin to be about 1,283 AFY.[687]

## Groundwater Pumping and Overdraft

Recent assessments of the LVGB indicate that groundwater overdraft does not pose a significant threat.[688] The current CASGEM rating of "very low priority" places the LVGB at a lower risk of overdraft than any other groundwater basin in the state for which special district legislation has been enacted.[689] DWR studies from the 1980s estimated annual groundwater production to be approximately 100 AFY, with an estimated 74 AFY for agricultural users and an estimated 28 AFY for municipal and industrial uses. This pales in comparison to the estimated safe yield figure of 1,283 AFY indicated in the same DWR document.[690] While these figures are out-of-date, the gap between pumping rates and perennial yield estimated in the DWR studies is large enough that it is unlikely that overdraft is occurring. The Basin's current CASGEM priority of "very low" provides further evidence that overdraft is less likely to be occurring.

## Monitoring and Reporting

There are no monitoring or reporting requirements for well operators in the LVGB. However, groundwater quality monitoring in Lassen County is performed by DWR at a number of wells in Lassen County. DWR monitors 23 wells once each four years, and has monitored 24 other wells sporadically for water quality, including temperature, pH, total dissolved solids (TDS), metals, nitrogen compounds, dissolved potassium, sodium, calcium, magnesium, boron, and hardness. Groundwater quality data has been collected in seven of 24 groundwater basins in Lassen County, including Long Valley.[691]

## Water Quality

There are limited data available on water quality in the LVGB. DWR studies from the 1980s indicate that groundwater is of the calcium-sodium bicarbonate type with TDS ranging from 127–570 milligrams per liter (mg/L).[692] That same report does not mention any other significant water quality impacts, nor does the most recent CASGEM report.

## Disputes

A small portion of the LVGB underlies Washoe County, Nevada, a region facing a severe urban water shortage, and the most recent CASGEM report mentions that groundwater exports to Reno are currently being evaluated.[693]

## Discussion

A JPA between Sierra and Lassen Counties provides a mechanism for management. Additionally, Lassen County has commissioned reports on the county's groundwater resources, including the LVGB, and is taking an active role in managing the county's groundwater.

## Analysis

- Lassen County has developed plans to manage groundwater within the county and provides some monitoring and oversight. Given the very low CASGEM rating and the sparse population density of the LVGB, overdraft appears to be unlikely.

- Although Lassen County is very sparsely populated, neighboring Washoe County, Nevada, a portion of which overlies the LVGB, has a rapidly growing urban population and water scarcity challenges. The most recent CASGEM report does indicate that Washoe County officials are currently evaluating the possibility of exporting water from the Basin for use in nearby Reno. Managing the LVGB sustainably in the longer term will require coordination between authorities on the California side of the LVGB and Washoe County officials.

| Funding | Enabling Legislation |
|---|---|
| **The Long Valley Groundwater Management District and Sierra Valley Groundwater Management District were both approved vis-á-vis the same piece of enabling legislation, SB 1391 (1980).** In 1985, they formed a Joint Powers Authority to manage their groundwater.<br><br>**Funding Mechanisms** (from the enabling legislation):<br>**1. Groundwater Extraction Charges:** These charges may only be levied within an existing "zone of benefit" as defined by the Board of Directors, and proceeds from such charges are specifically to be used either to purchase water to replenish groundwater aquifers, or to help finance one of the specific powers granted to the District in Section 601 of the enabling legislation. Groundwater extraction charges must be uniformly applied to all well operators within each zone of benefit, as defined by the Board of Directors.<br>**2. Management Charges:** These charges are to be levied on landholders on a per-acre basis within pre-defined zones of benefit. Property owners with fewer than 20 acres of land pay a flat rate for their management charges, while owners of more than 20 acres pay on a per-acre basis. All benefits gained from collecting such charges must accrue to residents of those zones of benefit. Management charges may be used to fund any power, project, or purpose for which the District is organized. | **Regulate pumping:** Yes (SB 1391)<br>**Import water:** Yes (as per SB 1391)<br>**Reclaim flood and storm water:** Yes (SB 1391)<br>**Regulate water transfers:** Yes (SB 1391)<br>**Governing body:** Enabling legislation SB 1391 allows the Board of Supervisors of Lassen and Sierra Counties to prescribe the form and organization of the Board of Directors, in accordance with the JPA outlined in the legislation. **Board members are appointed.**<br><br>**Enabling Legislation:** SB 1391 (1980)<br>http://sierravalleygmd.org/SenateBillNo.1391.pdf<br><br>Note: This same piece of legislation applies to both the Long Valley Groundwater Basin *and* the Sierra Valley Groundwater Basin. |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
|---|---|---|---|---|
| NA | DWR's 1997 estimates suggest that total extraction is around 102 AFY, with agricultural irrigation comprising roughly 74 AF and municipal and industrial uses comprising 28 AF. Given that groundwater levels were relatively stable during the 1990s, it is likely that safe yield is relatively close to these rates of production. | Groundwater levels held steady and/or have risen slightly during the period 1987–1999.<br><br>Figures from the 21st century are not readily available. | Data from the 1990s suggest that the LVGB was then close to balance between natural recharge rates and rates of groundwater extraction. | No specific overdraft-related impacts are identified. |

# Sierra Valley
# Groundwater Management District

## Overview

| | |
|---|---|
| **County** | Sierra and Plumas |
| **Area** | Basin: 183.9 sq mi;[694] Sierra Valley Watershed: 465 sq mi[695] |
| **Population** | Basin: 2,196 (2010)[696] |
| **CASGEM** | Medium[697] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Sierra Valley is located in eastern Plumas and Sierra Counties.[698] The Sierra Valley Groundwater Basin (SVGB) is bounded to the north by Reconnaissance Peak, to the west by Beckwourth Peak, and to the south and east by andesite and granitic rocks.[699] The groundwater is found in "a near-surface unconfined aquifer, a deeper confined aquifer, and deep-seated thermal water associated with faulting."[700] The SVGB contains Holocene sedimentary deposits including both alluvial fans and intermediate alluvium. Alluvial fans, located along the perimeter of the valley, are up to 200 feet thick, and provide both confined and unconfined groundwater, and are also recharge areas. The intermediate alluvium is found along streams and in the central portion of the SVGB where it is up to 50 feet thick and yields moderate amounts of groundwater to shallow wells. The basin also contains Pleistocene lake deposits and Pleistocene volcanic rocks. The lake deposits provide most of the groundwater developed in the valley and are up to 2,000 feet thick. The volcanic rocks range in thickness from 50 to 300 feet and yield large amounts of groundwater to wells.

Storage in the aquifer is estimated at 7.5 million acre-feet (AF) to a depth of 1,000 feet, and between 1 and 1.8 million AF to a depth of 200 feet.[701] The quantity of useable water is unknown.[702]

## Background to Special District Formation

Prior to 1980, the Sierra Valley was primarily a cattle-grazing area. By 1980, it had been classified as a basin with a "special problem" because large agricultural wells and impending population growth threatened groundwater in the basin. Existing wells were losing artesian head, and in some areas the level dropped below the ground surface, which made providing water for cattle in the winter complicated and expensive. With the drilling of large wells on the Nevada side of Long Valley near Bordertown, concerns increased that the Basin would be overdrafted.[703]

In response to these problems, the legislature created the Sierra Valley Groundwater Management District (SVGMD) through the SVGB Act of 1980 (Water Code App. 119-101), authorizing the Boards of Lassen and Sierra Counties to exercise a Joint Powers Agreement (JPA) for purposes of groundwater management in their basins. The Act authorized the formation of two independent Special Districts to manage the groundwater resources: the Long Valley Groundwater Management District and the SVGMD.[704] The Agreement was adopted in 1985.[705]

## Dates

**Creation of the Special District:** 1980
**Revisions or Amendments:** None
**Other:** 1985 – Lassen and Sierra Counties adopt a JPA to manage groundwater in their counties.

## Special District Summary

The SVGB Act of 1980 authorized the Boards of Lassen and Sierra Counties to exercise a Joint Powers Agreement for purposes of groundwater management. The Agreement was adopted in 1985 authorizing the formation of SVGMD.[706]

The legislation authorizes but does not require several management strategies after hearings and public notice and comment.[707] For example, through an ordinance the Board may authorize the District to:

- "store water in and recapture water from surface reservoirs or groundwater basins within the district"
- "acquire water and water rights within or outside of the district"
- "purchase and import water into the district"
- "conserve and reclaim water within or outside of the district and require conservation practices and measures within the district"
- "buy and sell water and water rights at such rates as shall be determined by the board of directors"
- "exchange water and water rights"
- "treat, inject, extract, or otherwise control water, including, but not limited to, control of extractions, well construction and drainage problems"
- "regulate groundwater replenishment programs and recapture supplemental groundwater resulting from such programs within the district as provided by this act"
- "have the sole right to store and recapture water in the groundwater basin"
- "commence and prosecute actions to enjoin unreasonable uses or methods of use of water within the district or outside of the district to the extent such uses or methods of use affect the groundwater supply within the district"[708]

The legislation also creates three tiers of water users. The lowest priority users are the exporters, regardless of whether or not they have a permit from the District or in what year they began exporting. In the event of overdraft, or threat of overdraft, extractions will be reduced or suspended.[709] If suspension of extraction by exporters is insufficient to prevent overdraft, then the SVGMD has the power to "limit or suspend extractions by District users."[710] Priority is divided between overlying in-basin users and overlying exporters.[711] In general, "overlying users have a prior right to groundwater within the SVGMD," however, the SVGMD can consider the "reasonable needs of off-basin users" and allocate groundwater to these users.[712] There is no evidence of water transfers in the basin. The SVGMD is also authorized to charge extraction fees to finance groundwater management services.[713] One such service has been funding for aquifer testing.[714]

## Water Users

When the SVGMD was first formed, the majority of the pumping was for agricultural use, specifically for cattle, however this use was being threatened by drilling of high-volume agricultural wells and water export to housing subdivisions in Nevada.[715] Now irrigation is the primary use of groundwater in the Sierra Valley Watershed.[716]

## Management Structure

A Board of Directors manages the established SVGMD.[717] This board has the power, after public notice and comment, to implement groundwater management activities detailed above in the Special District Summary.[718]

*Current management structure:*
The 2015 Board of Directors of the SVGMD is composed of seven members, including the Sierra and Plumas County Supervisors.[719] They meet the second Monday of every month and post agendas and meeting minutes on their website.[720]

## Management Strategies

*Exports*
The SVGMD restricts exports of groundwater.[721]

*Management fees*
Currently, the Board imposes groundwater management fees.[722] In addition, the SVGMD passed Ordinance 83-01, which implements "assured water supply rules."[723] Any person seeking a land use permit for a development requiring groundwater must file with the SVGMD, who then makes a finding as to whether or not there is sufficient supply.[724] If there is not, the local land use agency is not able to grant the permit.[725] This ordinance was updated in 2004.[726]

*Imported water*
As noted above in the Special District Summary, the SVGMD has the authority to purchase and import water into the District.[727] The Sierra Valley imports about 6,000 acre-feet per year (AFY) from the Little Truckee River for irrigation.[728]

*Recycled water*
Also as noted above in the Special District Summary, the SVGMD has the authority to recycle and recapture water;[729] however, there is no evidence that they have exercised this power.

## Monitoring and Reporting

As of 2014, water levels were measured by DWR in 45 active wells in the main part of Sierra Valley and in 7 wells in the Chilcoot sub-basin in the northeast part of the valley.[730] Groundwater levels are monitored in 34 of the wells, and 15 wells are monitored for water quality.[731] The SVGMD requires landowners to purchase a meter for every well that exceeds a flow rate of 100 gallons/minute. The District then maintains the meters and collects data monthly.[732]

## Safe Yield

The safe yield in the part of the SVGB with large capacity supply wells is about 6,000 AFY in the part of the valley now tapped by large-capacity wells.[733]

## Groundwater Pumping and Overdraft

The Special Act legislation allows the SVGMD to reduce or suspend extractions by exporters any time there is evidence of overdraft or threat of overdraft.[734] If the reduction or suspension of export is not enough to counteract the overdraft, the SVGMD may limit or suspend extractions by District users.[735] Limited rights of use are allocated "primarily on the basis of the number of acres overlying the basin or sub-basin that a user owns or leases in proportion to the total number of acres overlying the basin or sub-basin."[736]

During wet years, metered pumpage equaled 3,500–5,000 AFY. During dry years, metered pumpage equaled 8,000–12,000 AFY. Between 2005–2011, "the pumpage averaged about 7,800 AFY, which is greater than the estimated safe yield" of 6,000 AFY, water levels were generally lower in all of the wells measured in the valley in Spring 2015 than in Spring 2005, coinciding with the largest amount of annual pumpage since metering began. [737] To avoid overdraft, in 2015, a technical analysis recommended the District manually monitor water levels at the six District monitoring wells during months of heavy pumping.[738]

## Water Quality

The SVGMD and the Sierra and Plumas County Health Departments monitor groundwater quality.[739] In the Sierra Valley, "the poorest quality groundwater is found in the central west side of the valley where fault-associated thermal waters and hot springs yield water with high concentrations of boron, fluoride, iron, and sodium. Several wells in this area also have high arsenic and manganese concentrations."[740] The water quality issues in the Sierra Valley are generally linked to geologic conditions rather than agricultural impacts, "due to low irrigation and fertilizer and pesticide inputs. In addition, population is sparse, and impacts due to septic systems are not expected."[741]

## Disputes

The SVGMD "adopted an ordinance that limited the amount of groundwater that could be extracted," however a landowner challenged the ordinance and the SVGMD subsequently repealed it.[742] A search of Westlaw and Lexis revealed no disputes in court.

## Discussion

The SVGMD is authorized to manage groundwater in multiple ways. Given that the average pumpage over 2005–2011 was over the estimated safe yield, the District may need to utilize additional strategies to avoid further overdraft. By requiring that there must be sufficient groundwater supplies for SVGMD to approve any new development, the District is able to verify whether new users will exacerbate overdraft. However, this does not address the overdraft by current users or any accumulated overdraft. SVGMD does have the ability to reduce in-district water user's allocation, and this step may be of assistance if groundwater levels continue to decline.

## Analysis

This is a rural area, and centralized groundwater management by SVGMD is somewhat limited. The legislation authorizes several management strategies after hearings and public notice and comment, but it does not require action on these strategies. SVGMD does however require landowners to purchase a meter for every well that exceeds a flow rate of 100 gallons/minute, and the District then maintains the meters and collects data monthly. SVGMD also requires that there be sufficient groundwater supplies for it to approve any new development.

The basin is overdrafted and the spring of 2005 saw the largest amount of annual pumpage since metering began.

| Funding | Enabling Legislation |
| --- | --- |
| **1. General Fund:** Property tax<br>**2. State Water Facilities Fund:** Property tax override<br>**3. Water Facilities Fund:** Water sales<br>**4. General Obligation Bond Fund:** Bond sales<br>**5. Flood Protection and Stormwater Drainage Development Impact Fee Fund:** Drainage fees<br>**6. Water Enterprise/Reclamation Trust Fund:** Tonnage/recharge fees<br>**7. Vehicle Acquisition Fund:** Mileage fees<br>**8. Water Enterprise Expansion Fund:** Connection fees<br>**9/10. Water Enterprise Improve/Replacement Funds:** Water sales | **Regulate pumping:** Yes<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body:** At-large **Board of Directors elected by all registered voters living within the service area.** |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
| --- | --- | --- | --- | --- |
| About 6,000 AFY | Wet years: Metered pumpage = 3,500–5,000 AFY<br><br>Dry years: Metered pumpage = 8,000–12,000 AFY | 2013–2014: Average pumpage was about double the estimated safe yield.<br><br>Like many other groundwater basins in the Sierra, groundwater levels dropped in the late 1980s and early 1990s before rebounding to 1970s levels by the end of the 20th century. | Not available | Not available |

# Willow Creek Valley
# Groundwater Management District

## Overview

| | |
|---|---|
| **County** | Lassen |
| **Area** | Basin: 18.3 sq mi[743] |
| **Population** | Basin: 62 (2010)[744] |
| **CASGEM** | Very Low[745] |

CASGEM = California Statewide Groundwater Elevation Monitoring

The Willow Creek Valley Groundwater Basin (WCVGB) in Lassen County is bounded in the north by Horse Lake Mountain, in the west by Dean's Ridge, and in the south by Susanville Peak and the Antelope and Tunnison mountains.[746] The basin contains Holocene sedimentary deposits, Pleistocene to Holocene basalt, and Pliocene lake deposits.[747] The unconfined alluvial fan deposits in the Holocene sedimentary deposits yield moderate to large amounts of water to wells.[748]Recharge areas and aquifers are found in the Pleistocene to Holocene Basalt formations.[749] The Pliocene lake deposits have low permeability and yield water sufficient only for domestic and stock, rather than irrigation, purposes.[750]

Willow Creek Valley overlies the WCVGB. The valley is an agricultural area southeast of Eagle Lake in the central portion of Lassen County. It is approximately 7 miles long and 4 miles wide. Willow Creek flows originate from springs on the northeast edge of the valley and flows southeast through the valley. The ground surface in Willow Creek Valley gently slopes toward the southeast and locally toward Willow Creek. The floor of Willow Creek Valley ranges in elevation from 4,900 feet mean sea level (MSL) at the northwest end of the valley, to 4,880 feet MSL in the southeastern corner, where Willow Creek flows out of the basin.[751] Groundwater storage in the aquifer is unknown.[752]

## Background to District Formation

The Willow Creek Valley Groundwater Management District (WCVGMD) in Lassen County was formed in 1993 when the legislature found that "the preservation of the groundwater resources within the WCVGB for agricultural, municipal, and industrial uses is in the public interest and that the creation of the District pursuant to this act is…for the protection of agricultural and economic productivity."[753] The Board was appointed in 1994, but the District is currently inactive.

## Dates

**Creation of the Special District:** 1993
**Revisions or amendments:** None
**Other dates:** None

## Special District Summary

The legislation requires the District to annually prepare a groundwater supply and conditions report.[754] The legislation also authorizes but does not require several management strategies. For example, the District can require groundwater extraction facilities pumping over 100 gallons/minute for uses other than domestic to register with the District.[755] The District may also, by ordinance:

1. "store water in, and recapture water from, surface reservoirs or groundwater basins within the district."[756]
2. "conserve and reclaim water within or outside the district and require conservation practices and measures within the district."[757]
3. "construct conveyance, storage, or other water facilities to carry out this act."[758]
4. "treat, inject, extract, or otherwise regulate water, including, but not limited to, the regulation of extractions and drainage problems."[759]
5. "regulate groundwater replenishment programs and recapture supplemental groundwater" and "determine the amount of groundwater basin storage space available and to allocate groundwater basin storage space within the groundwater basin."[760]
6. "commence and prosecute actions to enjoin unreasonable uses or methods of use of groundwater…."[761]

Permits for exporting water from the District are not allowed unless the permit applicant establishes that there is available supply.[762] When, after public hearing and comment, the District establishes that there is overdraft, or threat of overdraft, groundwater exports will be restricted first.[763] If restrictions on exporters are insufficient to prevent overdraft, the District may restrict in-basin users' extraction.[764] The legislation also authorizes the District to charge extraction fees and management charges.[765]

## Water Users

There are 42 domestic well records and 8 irrigation well records on file for Willow Creek Valley.[766]

## Management Structure

*Management structure outlined in the legislation:*
The original board is appointed by the County Board of Supervisors and will serve until the extraction facilities are registered.[767] Five directors can be elected, at large, by "eligible voters."[768] Eligible voters are landowners in the District who have a facility capable of extracting 100 gallons per minute or more, exclusive of domestic use.[769] Given that there are only 62 people in the District, there are likely very few eligible voters.

*Current management structure:*
While a Board of Directors was appointed by 1994,[770] in 2003 the WCVGD was listed as inactive.[771]

## Management Strategies

While the WCVGMD is not active, Lassen County has stepped in and passed an ordinance that makes it unlawful to extract groundwater for export without a permit.[772] As of 2007, no permit applications had been submitted.[773] Similarly to the legislation discussed above, this ordinance prohibits the issuance of a permit unless the extraction will not cause overdraft; however, this determination is made by the County Board of Supervisors rather than proven by the applicant.[774]

## Monitoring and Reporting

"There are 42 domestic well records and 8 irrigation well records on file for Willow Creek Valley."[775] The District has the ability to require users with groundwater extraction facilities to file a statement that includes the amount of water pumped, the groundwater level and use, and acreage served by the facility.[776]

## Safe Yield

There is no defined safe yield for Willow Creek; rather Lassen County uses a basin management objective (BMO) framework to "overcome the problems of defining safe yield."[777] The county found that defining safe yield for all its basins was impossible and chose instead to use the BMO framework to help the "development of local groundwater management objectives and monitoring of the groundwater basin health to assure the water use is consistent with defined local objectives."[778]

## Groundwater Pumping and Overdraft

Most agricultural land in Willow Creek Valley is irrigated with surface water, and a small portion is irrigated with groundwater. Infiltration of irrigation water and the correlated low levels of groundwater pumping combine to protect the groundwater basin from major declines during drought periods that are evident in areas irrigated exclusively with groundwater.[779]

Hydrographs show that groundwater levels in Willow Creek Valley follow the same general trends in most parts of the valley. Generally, groundwater levels in Willow Creek Valley are high in the spring and lower in the fall, after water has been used during the summer. Hydrographs in Willow Creek Valley show between 5 to 10 feet of seasonal elevation change from spring to fall. Hydrographs in Willow Creek Valley also indicate that groundwater levels in Willow Creek Valley have not declined during drought periods. During the drought period from 1987 to 1991, spring groundwater levels were constant and did not decrease in elevation. However, the District did experience an overall decline in groundwater levels during this period, but levels recovered, and currently there is a seasonal fluctuation of 5–10 feet from spring to fall.[780]

## Water Quality

There is no current published information regarding groundwater quality.

## Disputes

A search of Westlaw and Lexis revealed no disputes in court.

## Discussion

The District is authorized to manage groundwater in a large variety of ways. However, because the District is inactive, it has not exercised its ability to do so. There is no evidence of overdraft.

| Funding Mechanisms | Other Capabilities |
|---|---|
| **Like other small Districts in the sparsely populated counties of the Sierra, online information on the WCVGMA is quite limited. The following information, taken from the enabling legislation, lists the following funding mechanisms:**<br><br>**1. Groundwater Extraction Charges:** These are to be assessed at a uniform rate within zones of benefit that are pre-defined by the Board of Directors. Such charges may be collected at the same time and in the same manner as *ad valorem* property taxes, but are to be based on well operators' self-reported extraction totals, rather than on property value.<br>**2. Management Charges:** These fixed charges may be set on an annual basis and are to be collected at the same time and in the same manner as *ad valorem* property taxes**.**<br>**3. Revenue Bonds: The enabling legislation states,** **"**The district may use the Revenue Bond Law of 1941 (Chapter 6 (commencing with Section 54300) of Part 1 of Division 2 of Title 5 of the Government Code, the Improvement Act of 1911 (Division 7 (commencing with Section 5000) of the Streets and Highways Code), the Improvement Act of 1915 (Division 10 (commencing with Section 8500) of the Streets and Highways Code), and the Municipal Improvement Act of 1913 (Division 12 (commencing with Section 10000) of the Streets and Highways Code), for the construction of any facilities authorized to be constructed by the district.<br>**For full text, see:**<br>http://codes.findlaw.com/ca/water-code-appendix/wca-sect-135-1001.html | **Regulate pumping:** Yes<br>**Import water:** Yes<br>**Reclaim flood and storm water:** Yes<br>**Regulate water transfers:** Yes<br>**Governing body elected by all the voters or just property owners:** Property owners only. Five Directors are to be elected by voters who meet the following criteria:<br><br>Eligible voters are owners of land with extraction facilities capable of producing more than 100 gpm. Each eligible voter is granted one vote for per acre of land owned that is irrigated by a well capable of producing greater than 100 gpm. No individual eligible voter shall possess more than 50% of the total votes possible among eligible voters living within the service area.<br><br>For further details see:<br>http://codes.findlaw.com/ca/water-code-appendix/wca-sect-135-402.html<br><br>There is no online record or resource where the entire text of the legislation is available as a single file or URL. The enabling legislation can be read on a section by section basis here:<br>http://codes.findlaw.com/ca/water-code-appendix/#!tid=NA761175A734544BF840294AC981A04EB (see Ch. 135) |

| Safe Yield | Extractions | Trends | Accumulated Overdraft | Overdraft Impacts |
|---|---|---|---|---|
| NA | 1905 AFY (DWR's 1997 survey estimates the Basin uses 1,900 AFY for agricultural irrigation and 5 AFY for municipal and industrial uses.) | No major declines, and currently there is a seasonal fluctuation of 5–10 feet from spring to fall. | The enabling legislation for this District passed in the early 1990s, at the same time that similar legislation formally established other special districts in Lassen County and adjacent counties in the Sierras. The other adjacent districts, for which more data are available, would indicate that groundwater levels were dropping in the late 1980s and early 1990s before stabilizing and increasing by the end of the 20th century. | Limited evidence indicates there is no land subsidence. |

[1] California Department of Water Resources. Bulletin 118, Chapter 2, http://www.water.ca.gov/pubs/groundwater/bulletin_118/california's_groundwater__bulletin_118_-_update_2003_/bulletin118-chapter2.pdf. See also 2013. Water Plan Update: Groundwater Enhancements and Recommendations. http://www.waterplan.water.ca.gov/docs/meeting_materials/plenary/2013.10.29-30/12-Workbook-GroundwaterEnhancements.pdf.
[2] For example, a Water Replenishment District (Water Code, § 60000 et seq.) is authorized to establish groundwater replenishment programs and collect fees for that service. A Water Conservation District (Water Code, § 75500 et seq.) can levy groundwater extraction fees. Most of these agencies are identified in the Water Code, but their specific authority related to groundwater management varies. The Water Code does not require that the agencies report their activities to the California Department of Water Resources (DWR).

[3] In 1992, Section 10750 et seq. (AB 3030) was added to the State Water Code, to allow certain local agencies that already exist to form a groundwater management plan. The local agency has to lie within a groundwater basin as defined in DWR Bulletin 118 or subsequent editions of that bulletin. Such a public agency, subject to notice, hearing and protest requirements, may adopt and implement a groundwater management plan and may exercise the powers of a water replenishment district to raise revenue.
[4] Langridge 2009, "Confronting Drought: Water Supply Planning and the Establishment of a Strategic Groundwater Reserve". University of Denver Water Law Review. 12(2)
[5] SGMA - AB 1739, SB 1168, AB 1319
[6] In 2009, the Legislature passed SBX7 6, which established, for the first time in California, collaboration between local monitoring parties and DWR to collect groundwater elevations statewide and that this information be made available to the public.
[7] These basins account for approximately 88 percent of the population and 96 percent of groundwater use in California (DWR 2014).
[8] Cal. Water Code, Section 10733.
[9] SWRCB, http://www.waterboards.ca.gov/water_issues/programs/gmp/sgma.shtml
[10] Id. Section 10727.2b (4), http://www.water.ca.gov/groundwater/sgm/definitions.cfm#uu.
[11] Cal. Water Code, §§ 10733-10733.8
[12] Cal. Water Code §10723 10723 (c)(1) and (c)(2)).
[13] Initially agricultural irrigation played a more significant role in groundwater production, but today large-scale agriculture is virtually absent from OCWD service area.
[14] SCVWD operates separate sets of policies between the densely populated, urban Santa Clara Valley Groundwater Basin and the more sparsely populated Llagas Sub-basin where irrigation still comprises a significant share of water use – this basin has less stringent regulations than the exclusively urban basin to the north.
[15] No data on agriculture
[16] 78 percent of total water use in 2015. Limited agricultural use around district margins.
[17] District service area supplied by the Cal-Am Water Company; agricultural irrigation supplied by private wells. Agriculture is limited, comprising less than half of total district water use.
[18] No agriculture. District only serves incorporated area of town
[19] Agriculture is the dominant water user, but the deep Fox Canyon aquifer also accounts for more than half of the water needs for 0.7 million residents in the cities of Ventura, Oxnard, Port Hueneme, Camarillo, and Moorpark, plus the unincorporated communities of Saticoy, El Rio, Somis, Moorpark Home Acres, Nyeland Acres, Leisure Village, Point Mugu, and Montalvo.
[20] Over 70 percent of production supplies agricultural irrigation.
[21] Agricultural irrigation is 85 percent of total groundwater production in service area. The City of Watsonville contains about half of the total district's population, and municipal production is only 15 percent, but relies on public water provision to meet municipal and industrial needs.
[22] Roughly 40 percent of production is for municipal use and distributed through public water system, The remainder consists of privately operated wells, predominantly supplying water for irrigation, but this also includes rural domestic wells.
[23] There is no publicly maintained distribution system located within district boundaries, leaving most residents reliant on private wells to meet domestic needs. Some irrigation but precise figures are not readily available. District has been activated, but has no permanent, full-time staff and no website.
[24] Limited information.
[25] Limited information.
[26] One of the most sparsely populated rural districts in the state, with both irrigated agriculture and a population that is heavily reliant on private wells to meet domestic and household needs, but a precise breakdown is unknown.
[27] In 1994, in *Baldwin v. County of Tehama,* the court upheld the authority of cities and counties, under their police powers, to regulate groundwater, including adopting ordinances to manage groundwater.
By the end of 2002, 22 of California's 58 counties had adopted ordinances that restrict the export of groundwater beyond the county's administrative boundaries.
[28] Hanak, Ellen, and Caitlin Dyckman. 2003. "Counties Wresting Control: Local Responses to California's Statewide Water Market". University of Denver Law Review. 6(2). 490-518.
[29] The ordinance carved out a few exceptions, including permits for the repair, modification, or replacement of existing wells, backup or standby wells that do not initiate any new or increased use of groundwater, and permits in areas subject to an existing groundwater adjudication.

[30] Most of these ordinances provide certain categorical and conditional exemptions to the permitting process. Many counties also provide a blanket exemption to permitting as long as quantities remain within historical use levels, and exempt specific types of local entities—such as incorporated cities and water districts—from permitting. In counties with ordinances restricting exports, those wishing to engage in the restricted activity must obtain a county permit, which invokes review under CEQA. There have been few requests for permits and even fewer permits granted. See Hanak, Ellen. 2003. "Who Should Be Allowed to Sell Water in California? Third-Party Issues and the Water Market." Public Policy Institute of California.

[31] Year in parentheses is year of adoption. If two dates are listed, the first refers to the adoption of an urgency ordinance and the second to the adoption of a regular ordinance. Many ordinances have been revised at least once subsequently.

[32] Bulletin 118 pg. 163 (2003).

[33] Christine Souza, *For groundwater, local management proves effective*, Ag Alert (Aug. 6, 2014), http://www.agalert.com/story/?id=7007.

[34] Id. At 3.4 and 10-1, 10-2.

[35] Samantha Clark, 4/25/16, "Santa Cruz County water experts take cue from solar industry," *Santa Cruz Sentinel* http://www.santacruzsentinel.com/article/NE/20160425/NEWS/160429807

[36] *Winters v. United States,* 207 U.S. 564 (1908)

[37] CASGEM, http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_Priority_05262014.pdf

[38] OCWD, 2015, *Groundwater Management Plan 2015 Update*, p. 1-1. http://www.ocwd.com/media/3503/groundwatermanagementplan2015update_20150624.pdf

[39] OCWD, 2015, *Groundwater Management Plan Update*, p. 1-1.

[40] OCWD, 2015, *Groundwater Management Plan Update*, p. 3-2. In DWR's Bulletin 118 (2003), these layers are referred to as Shallow, Middle, and Lower.

[41] Id. p. ES-2

[42] Id. p. 3-2 to 3-6.

[43] Id. p. 3-8 to 3-9.

[44] Id. p. 3-12.

[45] OCWD, 2014. *A History of Orange County Water District,* p. 24. http://www.ocwd.com/About/HistoricalInformation.aspx

[46] Id. at*,* p. 10-11.

[47] Blomquist, 1992. *Dividing the Waters: Governing Groundwater in Southern California*. San Francisco: ICS Press. pp. 247-8.

[48] OCWD, 2014. *A History of Orange County Water District,* p. 16.

[49] OCWD, 2015, *Groundwater Management Plan Update*, p. 1-1.

[50] Id.

[51] SLO County Water 2008 WRAC Agenda, http://www.slocountywater.org/site/Water%20Resources/Advisory%20Committee/Agendas/2008/WRAC-Agenda-0908-Docs-Submitted/S.Harvey%20Submittal.pdf

[52] OCWD, 2015, *Groundwater Management Plan Update*, p. 10-2 to 10-7.

[53] OCWD, 2015. 2013-14 Engineer's report on groundwater conditions, water supply, and basin utilization in the Orange County Water District, p. 13-15, http://www.ocwd.com/media/3304/ocwd-engineers-report-2013-2014.pdf

[54] OCWD, 2015. *Groundwater Management Plan Update*, p. 1-9.

[55] Id. p. 3-11.

[56] OCWD, 2015. 2013-14 Engineer's report on groundwater conditions, water supply, and basin utilization in the Orange County Water District, p. 35-36.

[57] OCWD, 2014. *A History of Orange County Water District,* pp. 16 and 26.

[58] OCWD, 2015, *Groundwater Management Plan Update*, pp. 1-6 to 1-9.

[59] OCWD, 2015. OCWD Overview and Links to Compensation and Public Records. http://www.ocwd.com/Transparency.aspx

[60] OCWD, 2015. *Groundwater Management Plan Update*, p. ES-11.

[61] Id. p. 5-4.

[62] Id. p. 10-2.

[63] Stipulated Judgment in the case of *Orange County Water District v. City of Chino, et al.,* Case No. 117628-County of Orange.

[64] Id. p. 5-5.

[65] Id. p. 5-2.

[66] Blomquist, 1992, pp. 250-53.

[67] Id., pp. 261-67.

[68] Id., pp.152. See also OCWD, 2014. A History of Orange County Water District.

[69] OCWD, 2015. *Groundwater Management Plan Update*, p. 6-3.

[70] Id. pp. 5-10 and 5-11.

[71] Id. p. 4-3.

[72] Id. p.p. 3-11.

[73] Id. p. 4-1 to 4-17.

[74] Blomquist, 1992, p. 247.

[75] OCWD, 2015, *Groundwater Management Plan Update*, p. 1-1.

[76] OCWD, 2015. 2013-14 Engineer's report, p. 1, p. 7.

[77] Id. p. 1, p. 7.

[78] OCWD 2013-14 Engineers Report p. 4, See also OCWD, 2015, *Groundwater Management Plan Update*, p. 5-4 and 5-8.

[79] OCWD 2013,2014 Engineers Report, p. 4, See also OCWD, 2015. At 3.4 and 10-1, 10-2.

[80] OCWD, 2015, *Groundwater Management Plan Update*, p. ES10 and 10-3.

[81] Id. at, p. 10-32.

[82] OCWD, 2015. 2013-14 Engineer's report, p. 13-15. See also OCWD, 2015, Groundwater Management Plan Update, p. 3-13 and 3-22.

[83] Id. at, p. 8-7 to 8-9.
[84] Id. at, p. 7-2 to 7-4.
[85] SAWPA, 2014. One Water One Watershed Plan 2.0. http://www.sawpa.org/owow-2-0-plan-2/
[86] Id. p. 3-13 to 3-17.
[87] Id. p. 3-19 to 3-20.
[88] Id. p.15.
[89] SCVWD, 2013. Annual Report, 2012-13, p. 5.
[90] U.S. Census Bureau, 2010. http://quickfacts.census.gov/qfd/states/06/06085.html
[91] Based on a GIS coverage of the DWR, comment from Vanessa de la Piedra, Unit Manager, Groundwater Monitoring and Analysis Unit SCVWD, 5/20/2016.
[92] CA DWR, 2004. Bulletin 118, Basin 3-3.01, http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/3-3.01.pdf
[93] SCVWD, 2013. Annual Report, 2012-13, p. 5
[94] CA DWR, 2014. CASGEM Groundwater Basin Prioritization Results, http://www.water.ca.gov/groundwater/casgem/pdfs/lists/StatewideBasinName_05262014.pdf, Basin Number 2-2.902
[95] Id. Basin number 3-3.01
[96] SCVWD, 2012. Groundwater Management Plan, p. 1-1.
[97] CA DWR, 2004. Bulletin 118, Basin 2-9.02, http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/2-9.02.pdf
[98] CA DWR, 2004. Bulletin 118, Basin 3-3.01, http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/3-3.01.pdf
[99] SCVWD, 2012. Groundwater Management Plan, p. 1-3.
[100] SCVWD, 2015. http://www.valleywater.org/About/History.aspx
[101] SCVWD, 2012. Groundwater Management Plan, p. 1-3.
[102] SCVWD, 2015. http://www.valleywater.org/About/History.aspx
[103] National Association of Counties, Mapping County Data, http://explorer.naco.org/#
[104] United States Census Bureau, 2010-2014 American Community Survey, http://www.census.gov/search-results.html?q=santa+clara+county&search.x=-989&search.y=-39&search=submit&page=1&stateGeo=none&searchtype=web
[105] https://archive.org/details/valley_of_hearts_delight
[106] SCVWD, 2015. http://www.valleywater.org/About/History.aspx
[107] 13 feet is the maximum recorded subsidence in Santa Clara County. Lesser amounts were observed over a wide area of over 100 square miles, SCVWD staff comment, 8/9/2016.
[108] Id.
[109] Id.
[110] Staff comments, 5/18/ 2016.
[111] SCVWD, 2015. Protection and Augmentation of Water Supplies 2014-15, p. 22.
[112] Id.
[113] Id. p. ii.
[114] SCVWD staff comment, 5/18/2016.
[115] Id, p. 9.
[116] CA, AB 2435 § 7.
[117] SCVWD 2015, http://www.valleywater.org/About/BoardOfDirectors.aspx
[118] CA, AB-466 § 7.7 (c)
[119] SCVWD 2015, http://www.valleywater.org/About/BoardOfDirectors.aspx
[120] SCVWD 2015, Budget-in-Brief FY 2014-15, p. III-16.
[121] Id. p. III-3.
[122] Id. p. III-11.
[123] SCVWD, 2015. http://www.valleywater.org/About/History.aspx
[124] SCVWD, 2012. Groundwater Management Plan, p. 1-3.
[125]Id. p. ES-2.
[126] SCVWD staff comment.
[127] SCVWD, 2012. Groundwater Management Plan, p. ES-2.
[128] Id. p. 2-18. SCVWD staff comment, 6/18/2016.
[129] SCVWD staff comment, 5/18/2016
[130] SCVWD, 2012. Groundwater Management Plan p. ES-5.
[131] Id. p. 3-5.
[132] Id. p. 3-5.
[133] Id. p. 3-6.
[134] Id. p. 3-6.
[135] Id. p. 3-6.
[136] Id. p. 3-7.
[137] Id. p. 3-7.
[138] Id, p. 31.
[139] SCVWD staff comment 5/20/16.
[140] SCVWD, 2015. http://www.valleywater.org/Programs/Wells.aspx
[141] SCVWD, 2015. Protection and Augmentation of Water Supplies 2014-15, p. ii.
[142] SCVWD, 2015. Resolution 91-53.
[143] Id.
[144] SCVWD staff comment 5/21/2016. See also SCVWD Annual Groundwater Report for 2015: See also http://www.valleywater.org/Search.aspx?searchtext=SCVWD%202014%20report

[145] Id.
[146] SCVWD, 2012, Groundwater Management Plan, P. 2-14.
[147] Id.
[148] SCVWD, 2015. Protection and Augmentation of Water Supplies 2014-15, p. ii and SCVWD staff comment 5/18,/2016.
[149] Id. p. iv.
[150] SCVWD staff comment, 5/17/2016.
[151] SCVWD, 2015. *Protection and Augmentation of Water Supplies* 2014-15*,* p. ii.
[152] SCVWD, 2015. *Protection and Augmentation of Water Supplies 2014-15,* p. ii.
[153] SCVWD, 2015. *Protection and Augmentation of Water Supplies 2014-15,* p. 3.
[154] SCVWD staff comments 5/13/2016 and 5/18/2016.
[155] SCVWD, 2015. *Protection and Augmentation of Water Supplies 2014-15,* p. ii.
[156] Staff updated with 2015 figures from 11/13/2015.
[157] SCVWD, 2015. Protection and Augmentation of Water Supplies 2016-17. Updated by SCVWD staff 5/18/2016.
[158]SCVWD, 2012. *Groundwater Management Plan 2012,* p. 4-10.
[159]SCVWD, 2012. *Groundwater Management Plan 2012,* p. 4-11.
[160] SCVWD staff comment 5/20/2016.
[161] SCVWD, 2012. *Groundwater Management Plan 2012,* p. 2-18.
[162] SCVWD, 2012. *Groundwater Management Plan 2012,* p. 4-16.
[163] SCVWD, 2012. *Groundwater Management Plan 2012,* p. 4-16.
[164] Staff comment 5/13/2016.
[165] Id.
[166] SCVWD, 2015 http://www.valleywater.org/watertracker.aspx
[167] SCVWD, 2015. Protection and Augmentation of Water Supplies 2014-15, p. ii.
[168] Id. p. 7.
[169] Id p. 15.
[170] Staff comment 5/18/2016.
[171] Id.
[172] Id.
[173] ACWD Fact Sheet, http://www.acwd.org/index.aspx?nid=93
[174] ACWD Survey Report on Groundwater Conditions, February 2016, http://www.acwd.org/DocumentCenter/View/119
[175] ACWD Fact Sheet, http://www.acwd.org/index.aspx?nid=93
[176] CA DWR, CASGEM Compliance.
[177] CA DWR, 2004. *Bulletin 118, Basin 2-9.01* http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/2-9.01.pdf
[178] CA DWR, 2004. *Bulletin 118, Basin 2-9.01* http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/2-9.01.pdf
[179] ACWD Survey Report on Groundwater Conditions ( 2016) p. 6 http://www.acwd.org/DocumentCenter/View/119
[180] CA DWR, 2004. *Bulletin 118, Basin 2-9.01* http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/2-9.01.pdf
[181] ACWD http://www.acwd.org/index.aspx?NID=100
[182] ACWD Survey Report on Groundwater Conditions (2016) p. 4-5.
[183] ACWD History, 2015. http://www.acwd.org/DocumentCenter/View/71
[184] Id.
[185] Alameda County, Statutes of 1962, Ch. 1942, amended (9/14/1970 and 9/18/1974).
[186] To implement the Policy, two reports are produced annually: Groundwater Monitoring Report and Survey Report on Groundwater Conditions. As recognized by DWR during the Local Groundwater Assistance grant application process, ACWD's amended Policy along with current versions of ACWD's Groundwater Monitoring Report and Survey Report on Groundwater Conditions are considered to be an appropriate Groundwater Management Plan.
[187] (California Water Code Section 31142.20 et seq.). Provides similar regulatory authority to ACWD that had been established through individual City Ordinances in 1973, as the local enforcement agency for wells, exploratory holes, other excavation, and appurtenances and provides flexibility to adapt to changing conditions and technologies in the well drilling and subsurface investigation industry as necessary.
[188] Other Important Dates:
1930 – The purchase of the Alvarado Pumping Station from the East Bay Municipal Utilities District (EBMUD) puts the ACWD in the water distribution business for the first time in its history.
1962 – The ACWD receives its first delivery of water from the South Aqueduct of the State Water Project (SWP), making the ACWD the first contractor in the state to receive SWP water.
1964 – Contract with San Francisco for water delivery from the Hetch Hetchy Reservoir, thereby reducing demand on the Niles Cone Basin.
1972 – Installation of Rubber Dam #1 to improve recharge operations in Alameda Creek.
1972 – Water levels in the Newark Aquifer return to above sea level, restoring the natural bay-ward flow in the aquifer and commencing the process of reversing saltwater intrusion.
1974 – Start of ACWD's Aquifer Reclamation Program to augment the removal of saltwater from the Nile Cone Basin.
1975 – Completed Mission San Jose Water Treatment Plant which reduced demand on the Niles Cone Basin.
1999 – Completed Quarry Lake Rehabilitation Project to enhance artificial and natural groundwater recharge.
2003 – Completed Phase 1 of the Newark Desalination Facility, which converts brackish groundwater from the Aquifer Reclamation Program into potable water.
2010 Completed Phase 2 expansion of the Newark Desalination Facility.
[189] ACWD, 2015. http://www.acwd.org/index.aspx?NID=91
[190] Id.

[191] Id. In 1975, when ACWD's water treatment plant was constructed, the district began to provide potable water.
[192] ACWD Urban Water Management Plan 2015-2020, http://www.acwd.org/DocumentCenter/View/1264
[193] Chapter 1492 of the Statutes of 1961 (As Amended September 14, 1970 and September 18, 1974) REPLENISHMENT ASSESSMENT ACT of the ALAMEDA COUNTY WATER DISTRICT, http://www.acwd.org/DocumentCenter/View/127
[194] ACWD legislation: http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=31001-32000&file=31142.20-31142.39
[195] ACWD Sources of Supply, http://www.acwd.org/DocumentCenter/View/18
[196] ACWD http://www.acwd.org/index.aspx?NID=100
[197] ACWD Survey Report on Groundwater Conditions (2016) p. 8, http://www.acwd.org/DocumentCenter/View/119
[198] ACWD Fact Sheet, 2015. http://www.acwd.org/index.aspx?nid=93, See also ACWD Urban Water Management Plan 2015-2020, http://www.acwd.org/DocumentCenter/View/1264
[199] Id.
[200] ACWD staff comment, 6/16.2016.
[201] ACWD 2015, http://acwd.org/index.aspx?NID=541&MOBILE=ON
[202] Id.
[203] ACWD 2015, http://www.acwd.org/DocumentCenter/View/50
[204] ACWD http://www.acwd.org/index.aspx?NID=100
[205] ACWD, 2015. http://www.acwd.org/index.aspx?NID=91
[206] ACWD Staff comment, 6/16/2016.
[207] Id.
[208] Id.
[209] ACWD 2015, http://www.acwd.org/index.aspx?nid=226
[210] ACWD, Groundwater Management Policy, 2001. p. A1-4.
[211] Id. p. A1-4.
[212] Id. p. A1-5.
[213] Id. p. A1-5.
[214] Id. p. A1-7.
[215] Id. p. A1-8.
[216] ACWD Survey Report on Groundwater Conditions, February 2016, p. 8, http://www.acwd.org/DocumentCenter/View/119, accessed 4/7/2015.
[217] ACWD, Groundwater Management Policy, 2001. p. A1-5.
[218] ACWD, Groundwater Monitoring Report 2014, p. 2.
[219] Id.
[220] ACWD, Well Ordinance 2010-01.
[221] Id.
[222] ACWD, UWMP 2010, p. 3-3.
[223] ACWD Urban Water Management Plan 2015-2020 at 4-7.
[224] ACWD, IRP 2014. p. 10-11.
[225] Id.
[226] Id. at. p. 13
[227] ACWD Survey Report on Groundwater Conditions (2016) p. 8-9.
[228] Id. at 14.
[229] ACWD, Groundwater Monitoring Report 2014, p. 6-7.
[230] Id. at, p.17.
[231] ACWD Staff comment, 6/16/2016.
[232] These concerns include the Delta ecosystem and potential future environmental regulations, levee stability, and the potential for catastrophic failure of these levees, urban encroachment within the Delta, and water quality within the Delta due to urban and agricultural discharges. ACWD Urban Water Management Plan 2015-2020. At 3-15.
[233] ACWD, IRP 2014. p. 13-15.
[234] Id. at. p. 10-11.
[235] Zone 7 Water Agency, 2015. http://www.zone7water.com/index.php/about-us/service-area
[236] CA DWR, 2004. *Bulletin 118, Basin 2-10.* http://www.water.ca.gov/groundwater/bulletin118/basindescriptions/2-10.pdf, accessed 10/31/2015.
[237] Zone 7 Water Agency, 2015. http://www.zone7water.com/index.php/about-us/service-area
[238] Zone 7 Urban Water Management Plan, 2015, 3-7 http://www.zone7water.com/images/pdf_docs/water_supply/uwmp_2015.pdf
[239] CA DWR, 2015. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/StatewidePriority_Abridged_05262014.pdf, accessed 10/31/2015.
[240] Zone 7 Water Agency, 2014. Groundwater Management Program Annual Report, p. 1-1, http://www.zone7water.com/index.php/36-public/content/76-groundwater-management-program-annual-report
[241] Zone 7 Water Agency, 2014. Groundwater Management Program Annual Report, p. 1-4.
[242] Id. p. 1-5.
[243] Id. p. 1-4.
[244] Id. p. 1-4.
[245] Id. p. 1-5.
[246] Id. p. 1-6
[247] Zone 7 Urban Water Management Plan, 2015, 3-3.
[248] Zone 7 Water Agency, 2015. http://www.zone7water.com/timeline/timeline.html

[249] Id.
[250] Id.
[251] Id.
[252] Id.
[253] Staff telephone interview, 6/2016.
[254] Zone 7 Water Agency, 2015. http://www.zone7water.com/timeline/timeline.html
[255] Id.
[256] Id.
[257] Zone 7 Water Agency, Annual Report 2014, p. 6, and Zone 7 Urban Water Management Plan 2015, 4-2.
[258] Zone 7 2015 Urban Water Management Plan, 4-1.
[259] Zone 7 Water Agency, 2015. http://www.zone7water.com/index.php/about-us/service-area
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