# CHAPTER IV

# GROUNDWATER BASIN REPORTS

# INLAND EMPIRE BASINS

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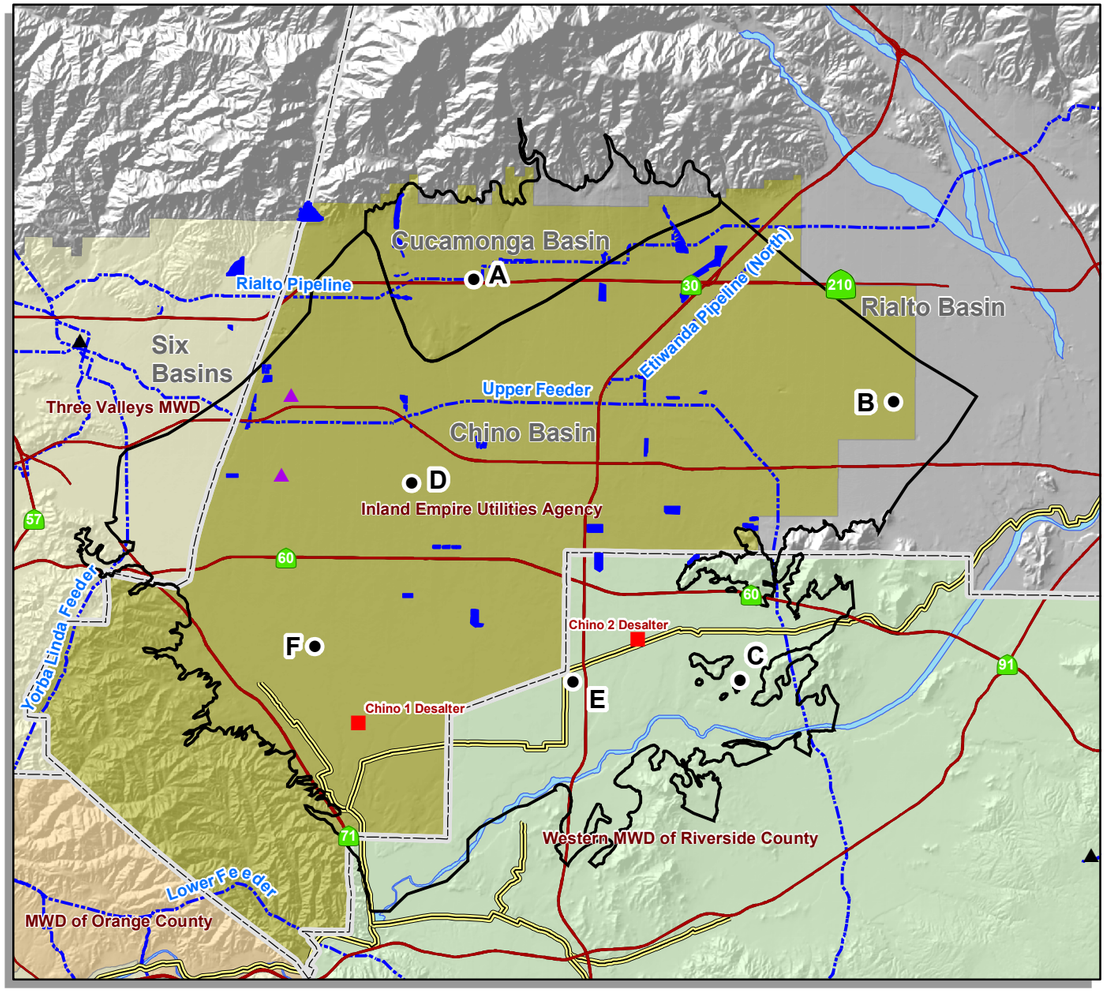


## Chino and Cucamonga Basins

A ● Key Well
▲ ASR Wells
■ Desalter
Recharge Basin
County
Freeways
Water Body
MWD Pipeline
▲ MWD Facility
Santa Ana Regional Interceptor Line
Basin
MWD Member Agency Boundary (color varies)

Note: This map was prepared by the Metropolitan Water District of Southern California for its own use. No warranty is expressed or implied as to the correctness, timeliness, or content of the information shown herein.

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Additional Data Sourse(s): Santa Ana Watershed Project Authority (SAWPA); California Spatial Information Library (CaSIL).

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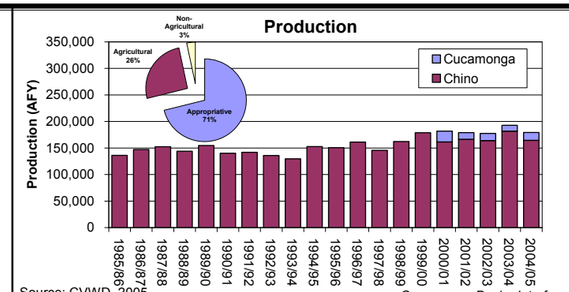
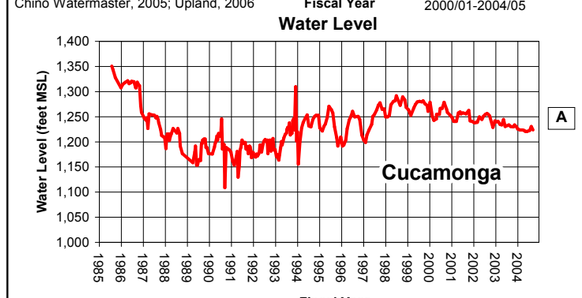
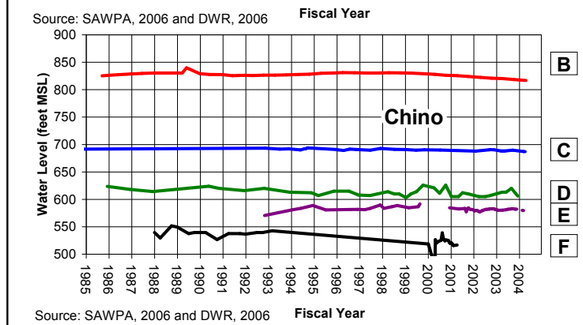


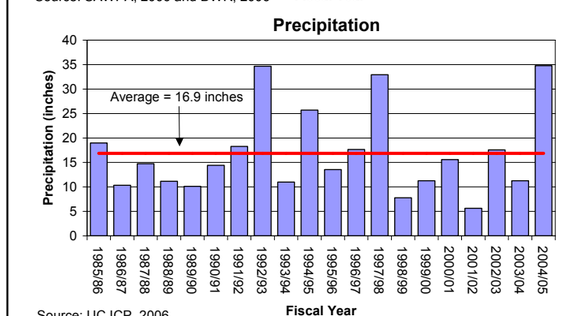

Source: CVWD, 2005
Chino Watermaster, 2005; Upland, 2006



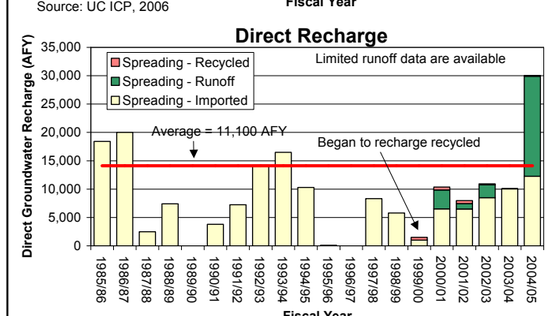

Source: SAWPA, 2006 and DWR, 2006




Source: SAWPA, 2006 and DWR, 2006




Source: UC ICP, 2006




## BASIN FACTS

### Chino and Cucamonga Basins

**Description**
**Location:** San Bernardino County
**Watershed Surface Area:** ~ 240 square miles
**Management:** Adjudicated
Chino Basin was adjudicated in 1978 and administered by Chino Basin Watermaster
Cucamonga Basin was adjudicated in 1958
**MWD Member Agencies:**
Inland Empire Utilities Agency
Western MWD
Three Valleys MWD

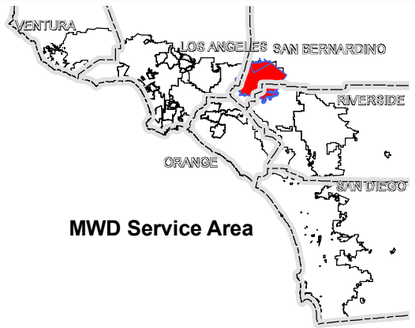
| | Chino | Cucamonga |
|---|---|---|
| **Natural Safe Yield** | 140,000 AFY | 13,800 to 22,200 AFY |
| **Adjudication Safe Yield** | 145,000 AFY | 22,721 AFY |
| **Total Storage** | ~6 million AF | Unknown |
| **Unused Storage Space** | ~1 million AF | Unknown |
| **Portion of Unused Storage Space Available for Storage** | ~500,000 AF | Unknown |

**Storage and Extraction Facilities**

| | Chino | Cucamonga |
|---|---|---|
| **Production Wells** | | |
| Production Capacity | >336,000 AFY | Unknown |
| Average 1985-2004 | ~154,000 AFY | ~15,000 AFY |
| **Injection Wells** | | |
| Injection Capacity | 4,500 AFY | None |
| Average 1985-2004 | None | None |
| **Spreading Basins** | | |
| Spreading Capacity | ~60,000 AFY | ~15,000 AFY |
| Average 1985-2004 | ~11,100 AFY | ~6,100 AFY |

**Basin Management Considerations**

- TDS and nitrate concentrations predominantly in southern portion of basin and several large VOC plumes are signficant issues for the basin.
- There are no court-ordered limits on pumping by groundwater users. However, pumping in excess of safe yield must be replenished.
- Desalters are used to cleanup basin, maintain hydraulic control and protect Santa Ana River water quality.
- Recent increased use of recycled water has increased management flexibility.




**MWD Service Area**

**Plate 12-1**
**Overview of Chino and Cucamonga Basins**

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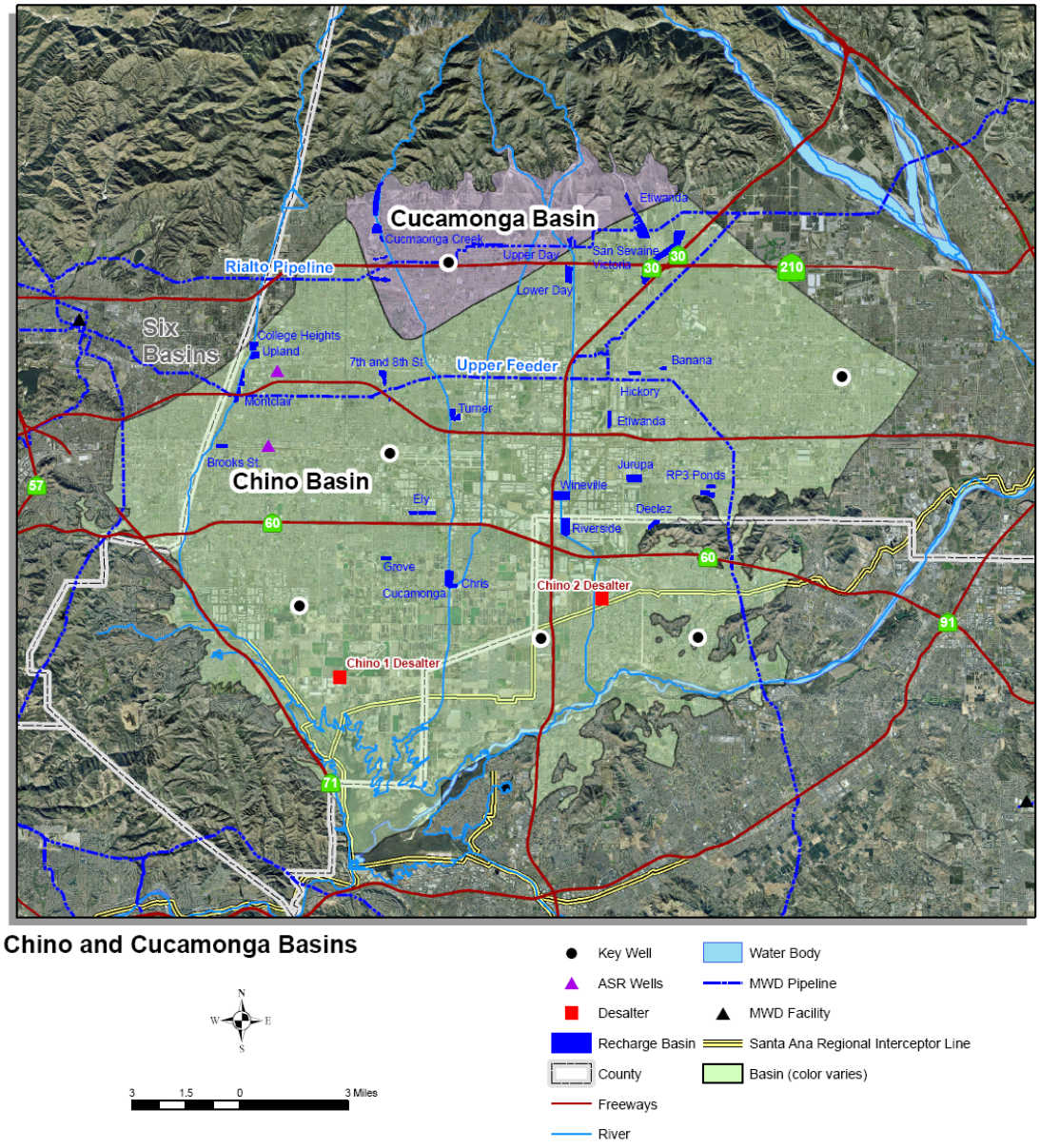
The Chino and Cucamonga Basins are located in the northwestern portion of the upper Santa Ana River Watershed in San Bernardino County and portions of western Riverside and northern Los Angeles Counties. The Chino and Cucamonga Basins underlie the service areas of Inland Empire Utilities Agency (IEUA), Western Municipal Water District (Western MWD) and Three Valleys Municipal Water District (Three Valleys). It includes the communities of Rancho Cucamonga, Pomona, Upland, Fontana, Chino, Chino Hills, Montclair, Jurupa Community Services District and Ontario. A map showing these basins is provided in **Figure 12-1**.

**Figure 12-1**
**Map of the Chino and Cucamonga Basins**



## BASIN CHARACTERIZATION

The following section provides a physical description of the Chino and Cucamonga Basins, including geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

**Table 12-1** provides a summary of hydrogeologic parameters of the Chino Basin and Cucamonga Basins. Each basin is discussed separately in the following section.

**Table 12-1**
**Summary of Hydrogeologic Parameters of Chino and Cucamonga Basins**

| Parameter | Chino Basin | Cucamonga Basin |
|---|---|---|
| **Structure** | | |
| Aquifer(s) | Upper aquifer (Layer 1)<br>Unconfined alluvium<br>Deep aquifer (Layers 2 and 3)<br>Confined alluvium | Unconfined older and younger alluvium |
| Depth of groundwater basin | Up to 1,100 feet | > 1,600 feet |
| Thickness of water-bearing units | Upper aquifer (Layer 1)<br>200 to 300 feet<br>Deep aquifer (Layer 2)<br>200 to 500 feet<br>Deep aquifer (Layer 3)<br>100 to 500 feet | Upper aquifer<br>Up to 150 feet<br>Deep aquifer<br>Up to 1,400 feet |
| **Yield and Storage** | | |
| Natural Safe Yield | 140,000 AFY | 13,800 to 22,200 AFY |
| Adjudication Safe Yield | 145,000 AFY | 22,721 AFY |
| Total Storage | ~ 6 million AF | Unknown |
| Unused Storage Space | ~1 million AF | |
| Portion of Unused Storage Space Available for Storage | ~500,000 AF | |

Source: Wildermuth, 2005a, DWR, 2006, CDM, 1985 Tom Dodson &Associates, 2000 and CDM, 1999

### Chino Basin

The Chino Basin is part of an alluvial-filled valley bounded by the Cucamonga Basin and the San Gabriel Mountains to the north, the Temescal Basin to the south, Chino Hills and Puente Hills to the southwest, the San Jose Hills and Six Basins on the northwest and the Rialto/Colton Basins on the east. The valley is relatively flat from east to west and slopes from the north to the south at a one to two percent grade. The Santa Ana River is the primary drainage for the valley, and flows from its origin in the San Bernardino Mountains to the Pacific Ocean (DWR, 2006).

The water-bearing sediments of the Chino Basin have been generally divided in to two aquifer systems: the Shallow aquifer system (referred to as Layer 1 or younger alluvium) and the Deep aquifer system (referred to as Layers 2 and 3 or older alluvium).

The Shallow aquifer system is generally characterized by unconfined to semi-confined groundwater conditions and high permeability within its sand and gravel units. Layer 1 consists of the upper 200 to 300 feet of sediments (Wildermuth, 2005a). The sediments that comprise the shallow aquifer system are saturated in the southern portion of Chino Basin, but are unsaturated in the northern portion. Where saturated, this zone is highly transmissive and yields high production rates.

The Deep aquifer system is generally characterized by confined groundwater conditions and lower permeability within sand and gravel units (Wildermuth, 2005a). The sediments that comprise the deep aquifer system are always at least partially saturated, and typically pinch out near bedrock outcrops and in the southern-most portion of Chino Basin. The upper portion of the Deep aquifer system (Layer 2) is approximately 200 to 500 feet thick. On the west side of Chino Basin, the sediments of Layer 2 are primarily silt and clay and become increasingly coarser in the northern and eastern portions of the basin. The lower portion of the Deep aquifer system (Layer 3) is approximately 100 to 500 feet thick. Layer 3 is only found in the central portion of the basin and pinches out near the boundaries. This zone is characterized by sand and gravel but are generally less productive than the shallower sediments in Layer 1 (Wildermuth, 2005a).

Total storage capacity of the Chino Basin is estimated to be approximately 6 million AF. There is currently about 5 million AF in storage leaving about 1 million AF unused (Wildermuth, 2005a). The Optimum Basin Management Program (OBMP) Program Environmental Impact Report (PEIR) identified 500,000 AF of the unused storage that could be utilized without significant impacts. The determination of the actual amount of the unused storage that could be used is subject to further review (Tom Dodson and Associates, 2000).

### Cucamonga Basin

The Cucamonga Basin underlies the northern part of upper Santa Ana Valley, and is bounded on the north by the San Gabriel Mountains and the Cucamonga fault and on the west, south and east by the Red Hill fault. The Red Hill fault is a barrier to groundwater flow, with groundwater

levels reported to be 225 to 375 feet higher on the north side than on the south of the fault. Groundwater flow is generally towards the south (DWR, 2004).

Groundwater occurrence in the Cucamonga Basin is generally unconfined within unconsolidated to loosely consolidated sand, gravel, and silt with a few beds of compacted clay. Like the Chino Basin, there are generally two aquifers within the Cucamonga Basin correlative with younger and older alluvium. The Upper aquifer (or younger alluvium) is characterized by unconsolidated silts, sands, gravels and boulders and can attain thickness of up to 150 feet in the vicinity of Cucamonga and Deer creeks. The Upper aquifer is generally unsaturated because groundwater is generally deeper than 150 feet. However, this aquifer allows for the infiltration of surface runoff in the groundwater. The Deep aquifer consists mostly of laterally discontinuous clays, silts, sands and gravels and reach a maximum thickness of 1,400 feet (CDM, 1999). Storage capacity within the Cucamonga Basin is unknown.

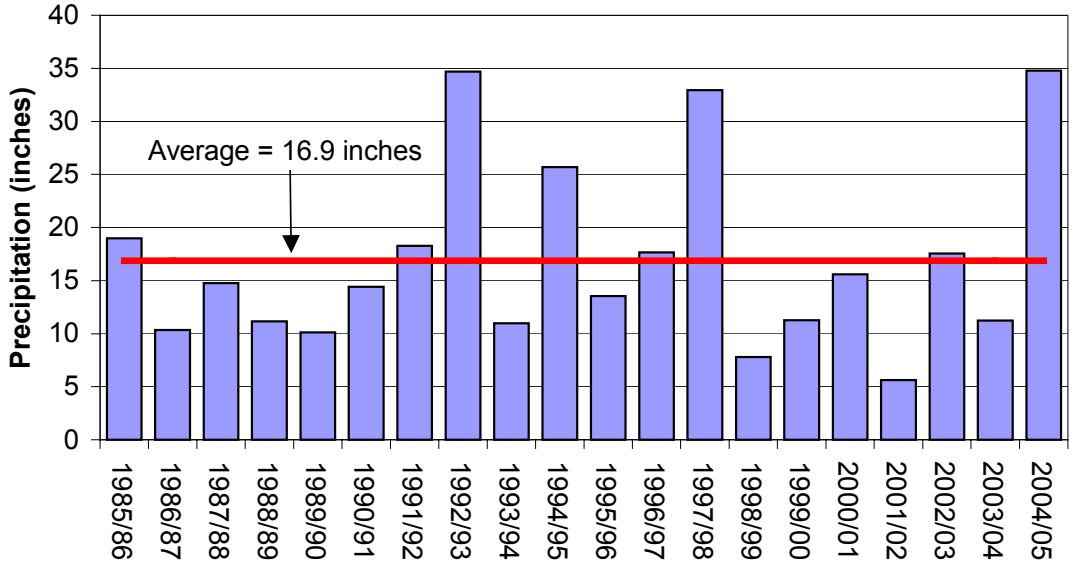
**Safe Yield/Long-Term Balance of Recharge and Discharge**

The natural sources of recharge and long-term balance for the Chino and Cucamonga Basins are discussed separately in the following section.

**Chino Basin**

Recharge to the groundwater is predominantly from percolation of direct precipitation and infiltration of stream flow from the surrounding mountains and hills, and from the Santa Ana River. **Figure 12-2** presents historical precipitation data during the period from fiscal years 1985/86 to 2004/05.

**Figure 12-2**
**Historical Precipitation in the Chino Basin**




Source: UC IPM, 2006 (Ontario.T Station)

During this period, an average of about 16.9 inches per year of rainfall occurred in the Chino Basin. Other sources of recharge include underflow from the saturated sediments and fractures within the bounding mountains and hills; recharge of storm water, imported water, and recycled water at spreading grounds; and underflow from seepage across faults (Wildermuth, 2005a).

Sources of discharge include groundwater production, rising water within Prado Basin, evapotranspiration where groundwater is near or at the ground surface, and underflow to adjacent basins (Wildermuth, 2005a). The Chino Basin's estimated natural safe yield is 140,000 AFY (Judgment, 1978). Artificial recharge of runoff, recycled and imported water allow the basin to sustain higher annual production than its safe yield.

#### Cucamonga Basin

Recharge to the Cucamonga Basin includes infiltration of stream flow, percolation of rainfall to the valley floor, underflow from the San Gabriel Mountains, and return irrigation flow. Spreading grounds along Cucamonga Creek and near Red Hill and Alta Loma also contribute to storm flow recharge to the basin (DWR, 2004). Average precipitation is higher in the Cucamonga Basin than the Chino Basin with historical average precipitation ranging from about 17.8 inches at the lower elevations to about 21.3 inches at the higher elevations (CDM, 1999).

Estimates of the safe yield of the geologically defined Cucamonga Basin range from 13,800 AFY (Howard, 1992) to 22,200 AFY (CDM, 1985). These estimates are less than the safe yield defined in the Cucamonga Basin Judgment of 22,271 AFY. It is important to note that the geologically defined area of the Cucamonga Basin is larger than the area subject to the Judgment (as described below). Therefore, the yield of the Judgment area would be expected to be less than the estimates above. For example, CDM (1985) estimated to sustainable yield of the geologically defined Cucamonga Basin to be 22,200 AFY and the sustainable yield of the adjudicated portion of the basin has been estimated to be approximately 19,100 AFY. The geologically-defined estimates are used throughout this document.

## GROUNDWATER MANAGEMENT

The following section describes how the Chino and Cucamonga Basins are currently managed. This includes a discussion of the management structure and relationship with adjoining basins.

### Basin Governance

The following section describes the management structure and adjudication of the Chino and Cucamonga Basins. A summary of the management agencies for the Chino and Cucamonga Basins is provided in **Tables 12-2 and 12-3**.

#### Chino Basin

The Chino Basin is an adjudicated basin. The groundwater rights and storage capacity within the Chino Basin were established by San Bernardino Superior Court Case No. 164327 in

*Chino Basin Municipal Water District v.City of Chino*, et al. in 1978, now designated No. RCV 51010 (referred to herein as the Chino Basin Judgment). In the Chino Basin Judgment, the Chino Basin Watermaster was appointed to administer and enforce the provisions of the Judgment and any subsequent instructions or orders of the Court.

**Table 12-2**
**Summary of Management Agencies in the Chino Basin**

| Agency | Role |
|---|---|
| Chino Basin Watermaster | Court-appointed Watermaster for Chino Basin. |
| Chino Basin Desalter Authority | Joint Powers Authority established to operate and manage the Chino I and Chino II Desalters. |
| Chino Basin Water Conservation District (CBWCD) | Operation of some recharge facilities in Chino Basin. The CBWCD also promotes water conservation through an active public education program. |
| San Bernardino County Flood Control District (SBCFCD) | Operation of some recharge and flood control facilities in Chino Basin. |
| City of Upland | Operation of one recharge facility in Chino Basin. |
| Monte Vista Water District | Owns and operates ASR wells in Chino Basin. |
| Santa Ana Watershed Project Authority (SAWPA) | Joint Powers Authority established to plan and build facilities to protect the water quality of the Santa Ana River Watershed. |
| San Bernardino County Department of Environmental Health | Regulation of new well permits within vicinity of recharge basins and throughout basin. |
| Inland Empire Utilities Agency (IEUA) | Implementation of recharge and management strategies.<br>Operation and maintenance of some recharge basins and associated facilities in Chino Basin. |
| Santa Ana River Watermaster | Watermaster for 1969 Stipulated Judgment that defined water allocations in the Santa Ana River between lower Santa Ana River and upper Santa Ana River producers. |
| California Department of Health Services | Regulation of water quality in recharge facilities and production wells. |
| Regional Water Quality Control Board – Santa Ana Region (Regional Board) | Regulation of recharge of recycled water and desalter facilities. |

As described above, the Chino Basin Judgment defines the natural safe yield as 140,000 AFY (Judgment, 1978). The safe yield is allocated among three pools as follows:

(1) Overlying Agricultural Pool (dairy farmers and the State of California): 82,800 AFY;
(2) Overlying Non-Agricultural Pool (industrial users): 7,366 AFY; and
(3) Appropriative Pool (water for municipalities and other government agencies): 49,834 AFY (Judgment, 1978).

An additional 5,000 AFY (200,000 AF of controlled overdraft, averaged over 40 years) is allocated to the Appropriative Pool, which defines the safe yield per the Chino Basin Judgment as 145,000 AFY. Parties are allowed to pump in excess of the safe yield as needed, provided replenishment water is later purchased and restored to the basin. Groundwater not pumped by the agricultural users (Overlying Agricultural Pool) is re-allocated to the Appropriative Pool for municipal use (Chino Basin Judgment, 1978).

The Superior Court mandated that the Chino Basin Watermaster develop an Optimum Basin Management Plan (OBMP). The OBMP, developed in 1998, established primary management goals to address issues, needs and interests of the water producers in Chino Basin, including four primary goals: (1) enhance basin water supplies, (2) protect and enhance water quality, (3) enhance management of the basin, and (4) equitably finance the OBMP (Wildermuth, 1999). In July 2000, the Watermaster's planning process culminated with the adoption of the Peace Agreement that ended over 15 years of litigation within the Chino Basin. The Peace Agreement outlines the schedule and actions for implementing the OBMP.

In 2004, the Regional Board adopted amendments to the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) incorporating a "maximum benefit" proposal recommended by IEUA and the Chino Basin Watermaster for the Chino Basin. The Maximum Benefit Basin Plan establishes new, scientifically-based Total Dissolved Solids (TDS) and Total Inorganic Nitrogen (TIN) groundwater quality objectives and wasteload allocations that allow the use of recycled water for groundwater recharge while providing reasonable protection of the groundwater quality in the region. As part of the Maximum Benefit Basin Plan, IEUA and the Chino Basin Watermaster have committed to a specific set of projects and requirements in order to demonstrate that the water quality of the groundwater basin is protected and that the plan provides the maximum benefit to the users of the groundwater basin. These commitments include implementation of the following projects (IEUA, 2006a):

- Surface water and groundwater monitoring programs;
- Chino desalters (consistent with OBMP requirements of 40 mgd by 2020);
- Recharge facilities/conjunctive use program;
- Recycled water quality management and
- Hydraulic control to protect the Santa Ana River quality (consistent with the Orange County Water District and IEUA Memorandum of Understanding).

Each of these elements has been implemented or is underway.

### Cucamonga Basin

The Cucamonga Basin is also adjudicated, as defined in the 1958 Judgment of the Superior Court (Decree No. 92645), herein referred to as the Cucamonga Basin Judgment. It is important to note that the basin's legal boundary established by the Cucamonga Basin Judgment is different from the geologic boundary depicted on **Figure 12-1.** The eastern boundary of the Cucamonga Basin defined in the Cucamonga Judgment is not based upon geologic features and, as a result, a portion of the geologically defined Cucamonga Basin is actually within the legal boundary of the Chino Basin.

**Table 12-3**
**Summary of Management Agencies in the Cucamonga Basin**

| Agency | Role |
|---|---|
| Chino Basin Watermaster | Court-appointed Watermaster for Chino Basin. |
| Cucamonga Valley Water District | Primary producer in basin. |
| San Antonio Water Company | Producer in basin and recharge of runoff in San Antonio Canyon Spreading Basins. |
| City of Upland | Not party to Judgment. However, pumps groundwater from basin using SAWC and West End Consolidated Water Company's rights. |
| San Bernardino County Flood Control District (SBCFCD) | Operation of some recharge and flood control facilities in Cucamonga Basin |
| Santa Ana Watershed Project Authority (SAWPA) | Joint Powers Authority established to plan and build facilities to protect the water quality of the Santa Ana River Watershed. |
| San Bernardino County Department of Environmental Health | Regulation of new well permits within vicinity of recharge basins and throughout basin. |
| California Department of Health Services | Regulation of water quality in recharge facilities and production wells. |
| Regional Water Quality Control Board – Santa Ana Region (Regional Board) | Regulation of recharge of recycled water and desalter facilities. |

The Cucamonga Basin Judgment stipulates water rights for Cucamonga Basin groundwater users. The Cucamonga Basin Judgment provides that 22,721 AFY may be pumped from the basin and approximately 3,620 AFY may be diverted from Cucamonga Creek. Santa Ana Water Company (SAWC), Cucamonga Valley Water District (CVWD) and the City of Upland (through agreements with SAWC and West End Consolidated Water Company) are the primary producers in the Cucamonga Basin. Under the Cucamonga Basin Judgment, SAWC is allowed to export 100 percent of their 6,500 AFY allocation while CVWD is allowed to export 8,177 AFY (43 percent of their total allocation of 19,071). The SAWC is required to recharge a minimum of

2,000 AFY imported water (mostly runoff) into the basin over a 10-year period. Over these ten years, 95 percent of any additional water spread may be added to SAWC's adjudicated right. The West End Consolidated Water Company rights of 750 AFY are currently pumped by the City of Upland (City of Upland, 2005).

### Interactions with Adjoining Basins

The Chino Basin is geographically adjacent to the Cucamonga, Six, Rialto-Colton and Temescal Basins. Except for the Temescal Basin, the aforementioned basins are adjudicated, and no formal agreements between the basins exist. Generally, the status quo of underflow is maintained.

The Chino Basin is upstream of the Orange County Basin. On April 17, 1969, the Orange County Superior Court entered a Stipulated Judgment in Case No. 117628 involving the Orange County Water District vs. City of City of Chino et al. The Judgment, which became effective October 1, 1970, contained a declaration of rights of the entities in the lower Santa Ana River area (i.e. OCWD) versus those in the upper Santa Ana River area (i.e. San Bernardino Valley Municipal Water District, or SBVMWD, Chino Basin MWD, now called IEUA, and Western MWD). The Judgment is administered by the Santa Ana River Watermaster, a committee of five members (one each from SBVMWD, IEUA and Western MWD and two from OCWD). Under this Judgment, purveyors upstream of Prado Dam, have the right to use all surface and groundwater supplies originating above Prado Dam without interference from water purveyors downstream of Prado Dam, provided that the average adjusted base flow at Prado Dam is at least 42,000 AFY. Baseflows have ranged from approximately 38,000 AFY in 1970 to approximately 170,000 AFY in 2002. (Santa Ana River Watermaster, 2003). SBVMWD has an obligation to ensure an average annual adjusted base flow of 15,250 AFY at Riverside Narrows. IEUA and Western MWD have a joint obligation to ensure average annual adjusted base flow of 42,000 AFY at Prado Dam. In addition, SBVMWD, IEUA and Western MWD are prohibited from exporting water from the lower area to the upper area while OCWD is prohibited from exporting water or causing water to flow from the upper area to the lower area (Santa Ana River Watermaster, 2003).

## WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Chino and Cucamonga Basins. Facilities include nearly 800 groundwater production wells (including 2 ASR wells), about 350 acres of spreading basins and 2 desalters.

### Municipal Production Wells

The following section provides a summary of the municipal production in the Chino and Cucamonga Basins. **Table 12-4** summarizes the production well information for each basin.

**Table 12-4**
**Summary of Production Wells in the Chino and Cucamonga Basins**

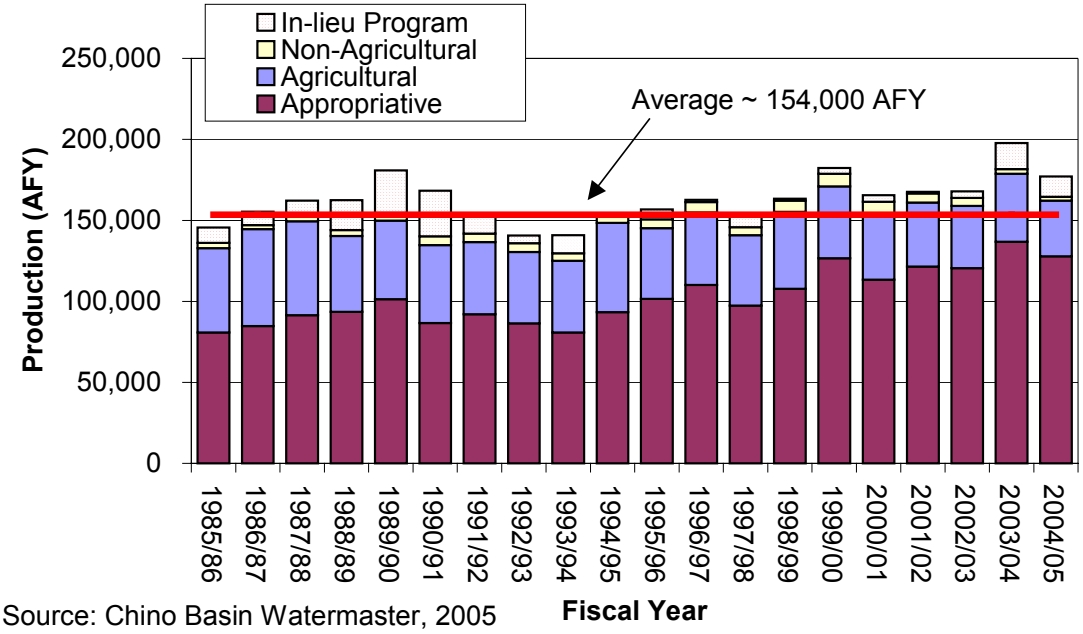
| Category | Number of Wells | Estimated Production Capacity (AFY) | Average Production 1985-2004 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| **Chino Basin** | | | | Data not available |
| Appropriative Pool | 193 Production 14 Monitoring | 286,000 | 102,749 | |
| Agricultural | 530 | >42,000 | 45,961 | |
| Non-Agricultural | 25 Production 22 Monitoring | >8,000 | 4,870 | |
| **Total Chino Basin** | 748 Production 22 Monitoring | >336,000 | **153,581** | |
| **Cucamonga Basin** | ~25 | Data not available | 14,452 [1] | |

Source: CBWM, 2006; B&V, 2003
**Note**: Data for Cucamonga Basin from 2000 to 2004 only.

**Chino Basin**

**Figure 12-3** presents the average basin production for the 20-year period from fiscal year 1985/86 to 2004/2005. During this time period, total groundwater production has ranged from a about 130,000 to 182,000 AFY, with an average of about 154,000 AF. Generally, over time, Agricultural Pool production in the southern portion of the basin has decreased, while Appropriative Pool production, mainly in the northern portion of the basin, has increased. For example, Appropriative Pool production increased from about 60 percent of total production in 1985/86 to 80 percent in 2004/05.

**Figure 12-3**
**Historical Groundwater Production in the Chino Basin**




Source: Chino Basin Watermaster, 2005

Water purveyors in the Chino Basin also participate in a variety of in-lieu groundwater storage programs whereby they receive imported water from Metropolitan in-lieu of pumping groundwater. These programs result in decreased pumping when water is delivered and increased pumping later. Historically, these have included Metropolitan's cyclic, replenishment water and conjunctive use programs. The long-term in-lieu storage (cyclic, replenishment or conjunctive use) is included in the data provided in **Figure 12-3**. Between fiscal years 1985/86 and 2004/05, about 9,300 AFY was stored in the Chino Basin via in-lieu. These and other storage programs are discussed in more detail below.

### Cucamonga Basin

As discussed above, there are three groundwater producers in the Cucamonga Basin. In the period between 2000 and 2004, the average production in the Cucamonga Basin was approximately 14,500 AFY, which is similar to the long-term average production in the basin. Note that production in these five years is significantly lower than the peak period between 1985 and 1989 (when production was more than 25,000 AFY) as a result of declining water levels due to dry conditions and water quality issues.

## Other Production

The following provides a brief summary of other, non-municipal production from the Chino and Cucamonga Basins.

#### Chino Basin

For Chino Basin, non-municipal production includes agricultural wells, industrial wells, and domestic wells. As of June 1, 2005, Watermaster counted about 530 active agricultural wells, 45 of which were anticipated to become inactive within 18 to 24 months due to urban development in the southern portion of Chino Basin (Wildermuth, 2005a). Production from these wells is included in **Figure 12-3**.

#### Cucamonga Basin

CVWD obtains a significant portion of its water supply from surface flows from the adjacent canyons. In the past 10 years, surface diversions have ranged from 1,892 AFY in 2004 to 9,580 AF in 1998 (CVWD, 2005). These diversions are treated in accordance with DHS guidelines and served for municipal demand. These surface water flows are not recharged.

### ASR Wells

The following section describes the ASR wells in the Chino and Cucamonga Basins.

#### Chino Basin

The Monte Vista Water District (MVWD) has recently implemented the Aquifer Storage and Recovery (ASR) Program by converting existing wells whose water quality has been impacted by high nitrates to ASR. MVWD has constructed two new ASR wells and modified several existing facilities. The ASR wells with wellhead treatment have the ability to provide up to 4,500 AFY of additional recharge capacity within the western part of the Chino Basin (IEUA, 2005). An additional 2 ASR wells are being considered. No injection occurred from these new wells during the period from 1985 to 2004.

#### Cucamonga Basin

There are no ASR wells in the Cucamonga Basin.

### Spreading Basins

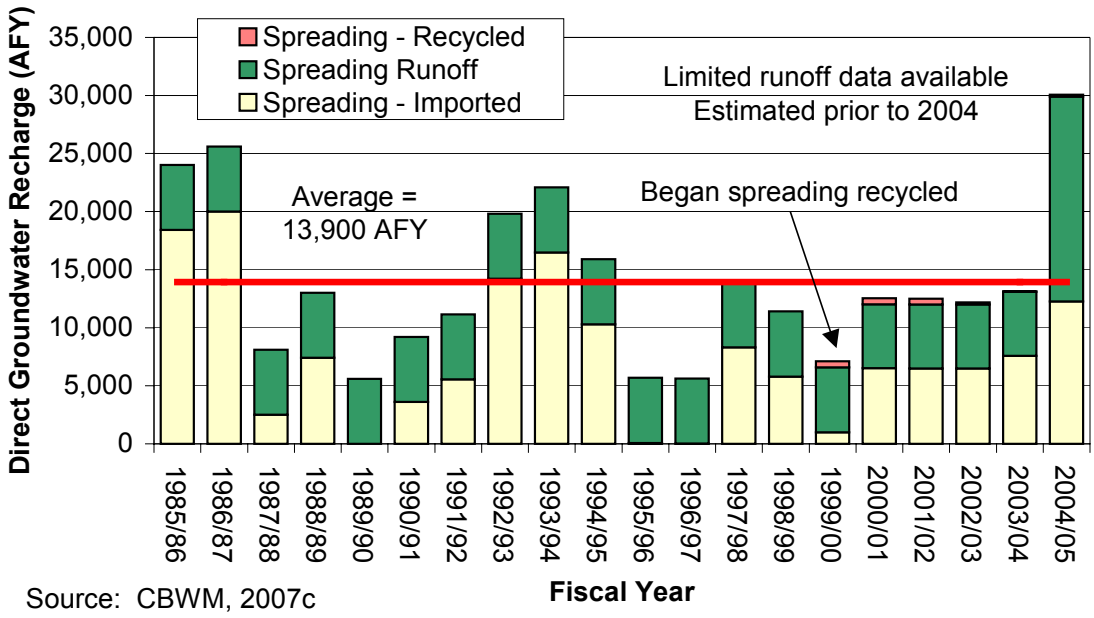
About 350 acres of spreading basins are located in the Chino and Cucamonga Basins. These are described below.

#### Chino Basin

Spreading basins are a key component of groundwater management in the Chino Basin. Data related to the recharge basins in the Chino Basin are summarized in **Table 12-5**. Imported water, recycled water and stormwater are currently spread in the Chino Basin. **Figure 12-4** shows historical groundwater recharge by spreading. An average of about 13,900 AFY has been spread between fiscal years 1985/86 and 2004/05 (CBWM, 2007c). About 7,700 AFY has been recharged with imported water from Metropolitan between fiscal years 1985/86 and 2004/05. Runoff recharge was not measured prior to 2004. However, the Chino Basin Watermaster

estimates that the historical runoff spread was approximately 5,600 AFY (CBWM, 2007c). In fiscal year 1999/00, recycled water began to be recharged in the Ely Basins and since then, an average of about 300 AFY of recycled water has been recharged in the Chino Basin. IEUA is planning to increase the amount of recycled water recharge in the future. According to the Chino Basin Watermaster, there is currently about 60,000 AFY of available capacity for supplemental recharge, including about 50,000 AFY of imported and recycled water capacity and 10,000 AFY of stormwater capacity (Chino Basin Watermaster, 2006). Additional improvements currently identified under the OBMP could increase the capacity to 134,000 AFY (IEUA, 2005).

**Figure 12-4**
**Historical Groundwater Recharge in the Chino Basin**




Source: CBWM, 2007c

### Cucamonga Basin

Spreading in the Cucamonga Basin is at the Cucamonga Creek and the Upper Day Creek Spreading Basins. Data related to these facilities is summarized in **Table 12-6**. SAWC imports water from San Antonio Creek for recharge in the Cucamonga Creek Spreading Basins. Imported water from Metropolitan has been recharged at the Upper Day Creek Spreading Basins since 1978. Because the Upper Day Creek Spreading Basins are located immediately adjacent to the boundary with the Chino Basin, it is unknown how much of this infiltration actually provides recharge to the Cucamonga Basin. The total estimated recharge capacity of both recharge areas is approximately 14,900 AFY based upon historical data since 1958. The average spreading in the Cucamonga Creek Spreading Basins from 1985 to 1997 was approximately 3,750 AFY. Between 1978 and 1991, Chino Basin Watermaster spread an average of about 2,390 AFY in the Day Creek Spreading Basins (CDM, 1999).

**Table 12-5**
**Summary of Spreading Basins in the Chino Basin**

| Spreading Basin | Wetted Area (acres) | Recharge Capacity (cfs) | Recharge Capacity (AFY) | Source Water | Owner |
|---|---|---|---|---|---|
| College Heights | 22 | 6 | 3,870 | Imported | CBWCD |
| Brooks Street | 7.7 | 5 | 3,000 | Runoff Imported | CBWCD |
| Montclair | 28.2 | 10 | 7,770 | Runoff Imported | CBWCD |
| 7th & 8th Street | 14.5 | 5 | 1,350 | Runoff | SBCFCD |
| Upland | 10.1 | 4 | 2,730 | Runoff Imported | City of Upland |
| Ely | 35.7 | 3 | 2,880 | Runoff Recycled | SBCFCD/CBWCD |
| Etiwanda Debris Basin | 20 | 5 | 5,250 | Runoff | SBCFCD |
| Hickory | 8 | 6 | 2,280 | Runoff Imported Recycled | SBCFCD |
| Lower Day Creek | 14.4 | 6 | 3,150 | Runoff Imported | SBCFCD |
| San Sevaine (1,2,3) | 33.6 | 10 | 7,740 | Runoff Imported | SBCFCD |
| San Sevaine (4, 5) | 56.5 | 10 | 7,740 | Runoff Imported | SCBCFCD |
| Turner Nos. 1,2 | 12 | 3 | 3,980 | Runoff Imported Recycled | SBCFCD |
| Turner Nos. 3,4 | 12 | 3 | | Runoff Imported Recycled | SBCFCD |
| Victoria | 11.8 | 2 | 1,260 | Runoff | SBCFCD |
| Banana | 6.2 | 4 | 2,010 | Runoff Imported Recycled | SBCFCD |
| Declez | 6.0 | 2 | 1,590 | Runoff | SBCFCD |
| RP3 Ponds | 18 | 3 | 3,000 | Runoff Imported Recycled | IEUA |
| **TOTAL** | **319.7** | **87** | **59,600** | **--** | **--** |

Source: Chino Basin Watermaster, 2007b and Wildermuth, 2005a

**Table 12-6**
**Summary of Spreading Basins in the Cucamonga Basin**

| Spreading Basin | Recharge Capacity [1] (AFY) | Source Water |
|---|---|---|
| Cucamonga Creek | 10,100 | Runoff |
| Upper Day Creek | 4,800 | Imported |
| **Total** | **14,900** | -- |

Notes: [1]Based upon maximum historical recharge

**Seawater Intrusion Barriers**

There are no seawater intrusion barriers in the Chino and Cucamonga Basins.

**Desalters**

There are two groundwater desalters in the Chino Basin designed to treat high-nitrate and TDS water from the southern part of the Chino Basin (Chino I and Chino II). In addition to reducing the TDS and nitrates in the groundwater, the desalters also provide hydraulic control for the southern portion of the basin. The maximum benefit concept approved by the Regional Board provides that hydraulic control and water quality improvement projects could be implemented to prevent degradation of adjacent water supplies such as the Santa Ana River. The southern portion of the Chino Basin was identified with the intent to control and managed the outflow of groundwater with high-TDS and nitrates into the Santa Ana River. The Chino Desalter Authority was established in 2001 to reclaim the groundwater in the southern Chino Basin. It is estimated that as much as 50,000 AFY of groundwater will need to be extracted from the southern portion of the basin to maintain hydrologic control and prevent groundwater from the Chino Basin from entering the Santa Ana River (Chino Desalter Authority, 2005).

The Chino I Desalter, which initially came online in August 2000 and upgraded in July 2005, produces up to 15,900 AFY of potable water. Facilities consist of 14 groundwater wells, a reverse osmosis (RO) water treatment plant (WTP), and pipelines to deliver water to and from the WTP to the water retailers, and a stripping tower to remove volatile organic compounds (VOCs). Brine concentrate from the RO process is discharged to the Santa Ana Regional Interceptor (SARI), which is treated at the Orange County Sanitation District facility in Orange County (Chino Desalter Authority, 2005). Through fiscal year 2004/05, about 7,900 AFY has been treated by the Chino I desalter (IEUA, 2006b).

The Chino II Desalter, which came online in June 2006, produces up to 10,200 AFY. Similar to the Chino I Desalter, facilities include 8 groundwater wells, RO facilities and associated pipelines. No water was produced from the desalter during the time period from fiscal years 1985/86 to 2004/05 (IEUA, 2006b).

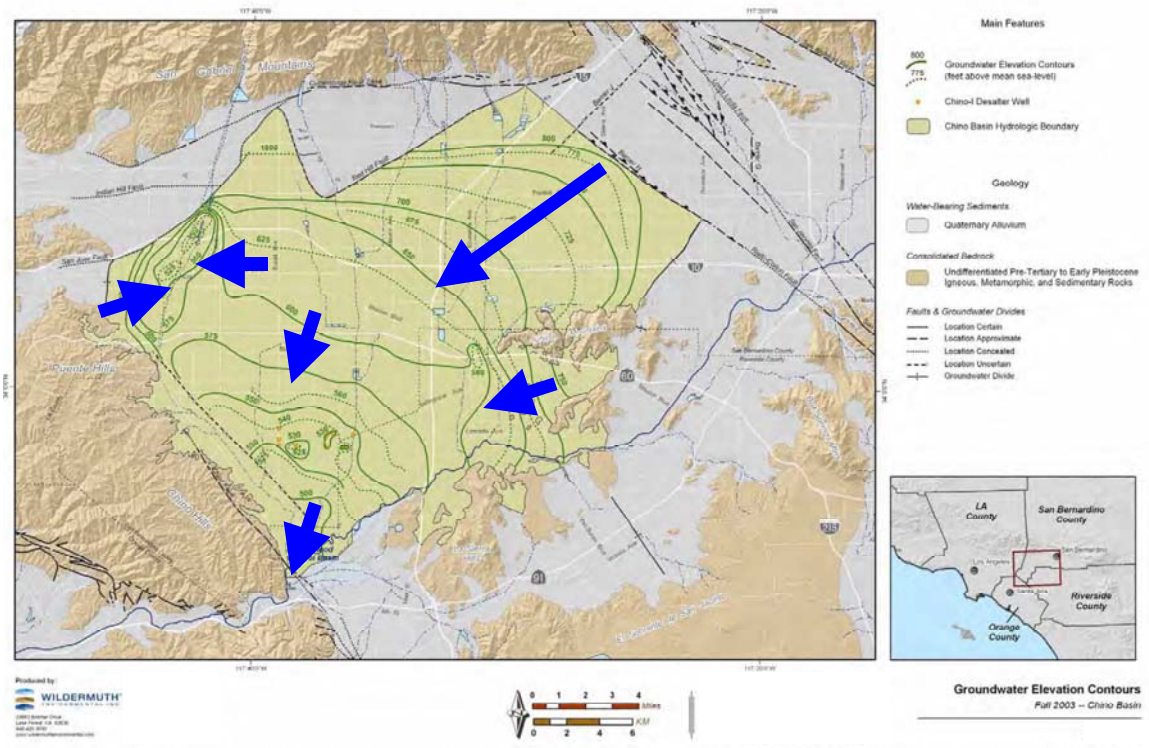
## GROUNDWATER LEVELS

The following section provides a description of groundwater levels in the Chino and Cucamonga Basins.

### Chino Basin

In the Chino Basin, surface drainage patterns generally flow from the areas in the north and east flanking the San Gabriel and Jurupa Mountains towards areas of discharge near the Santa Ana River within the Prado Flood Control Basin. Groundwater flow generally follows the same pattern. As shown on **Figure 12-5**, groundwater elevations within the Chino Basin range from less than 500 feet, above MSL to over 1,000 feet MSL. Notable groundwater depressions can be seen in the Pomona-Montclair area of the western portion of the basin and near the Chino I Desalter.

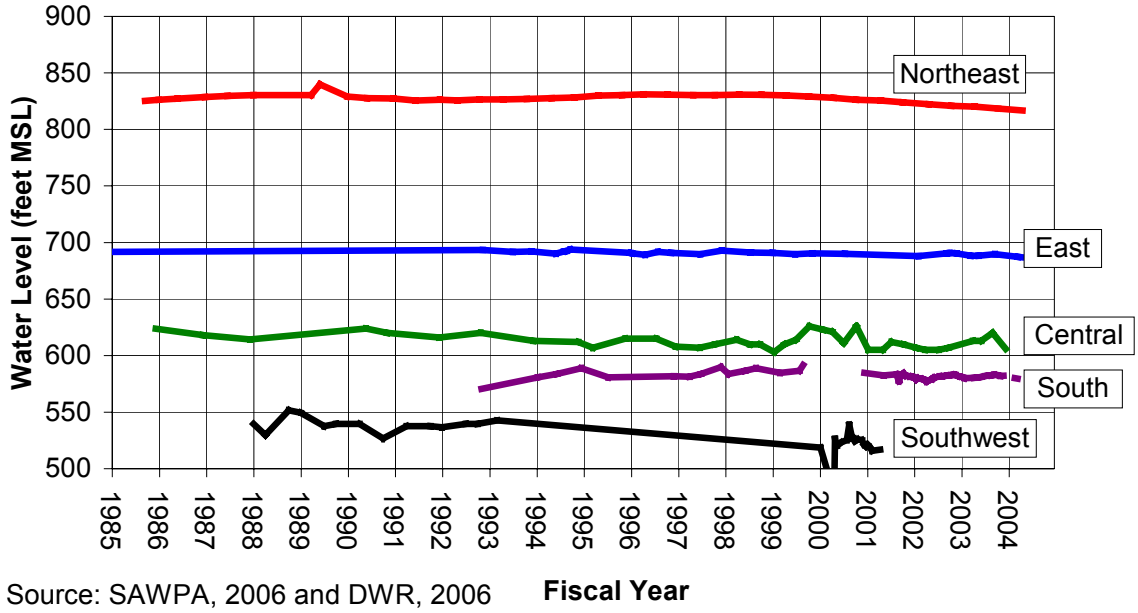
**Figure 12-5**
**Groundwater Contour Map in the Chino Basin – Fall 2003**




Source: Wildermuth, 2005a

Groundwater levels over time in various areas within the Chino Basin are shown on **Figure 12-6**. Groundwater levels appear to have stabilized since the Chino Basin Judgment was implemented and groundwater production has been managed within the Basin's safe yield. Water levels in some areas, particularly in the western portion of the basin near the boundary with Six Basins, continued to decline in the period between 1985 and 2004.

**Figure 12-6**
**Historical Water Levels in the Chino Basin**



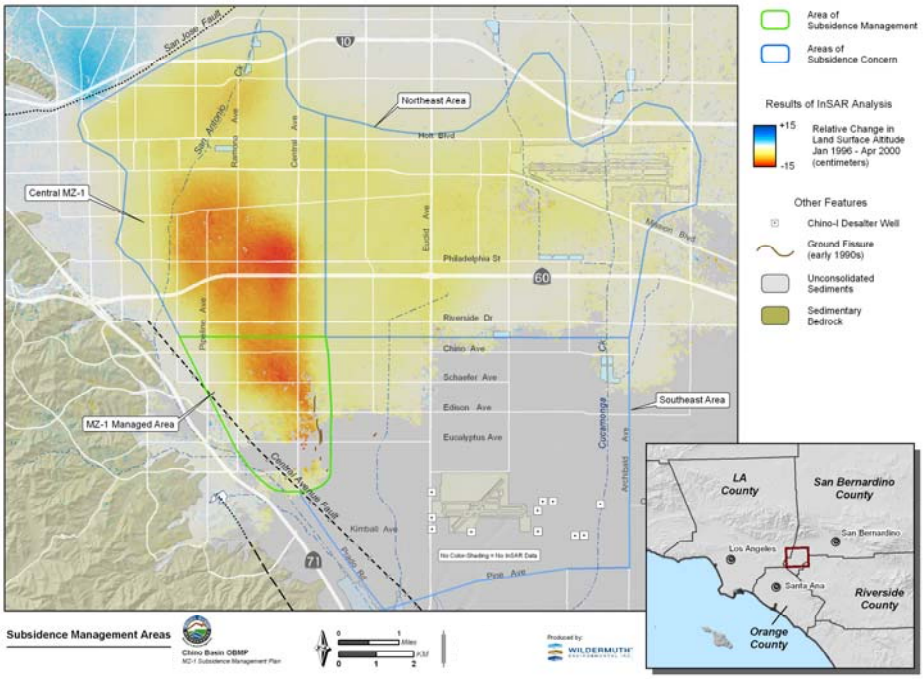

Source: SAWPA, 2006 and DWR, 2006

Land subsidence and ground fissuring have been observed in the area underlying the City of Chino and the California Institution for Men in the southern portion of the basin, which has been attributed to groundwater extraction as shown in **Figure 12-7**. As shown in this figure, land surface elevations dropped as much as 15 cm, or about 6 inches, in the five-year period between 1996 and 2000. In order to minimize further subsidence, a monitoring plan has been formulated and implemented. The new ASR wells and expansion of the recharge basin capacities discussed above are intended to increase the recharge to this area. Management is ongoing.

### Cucamonga Basin

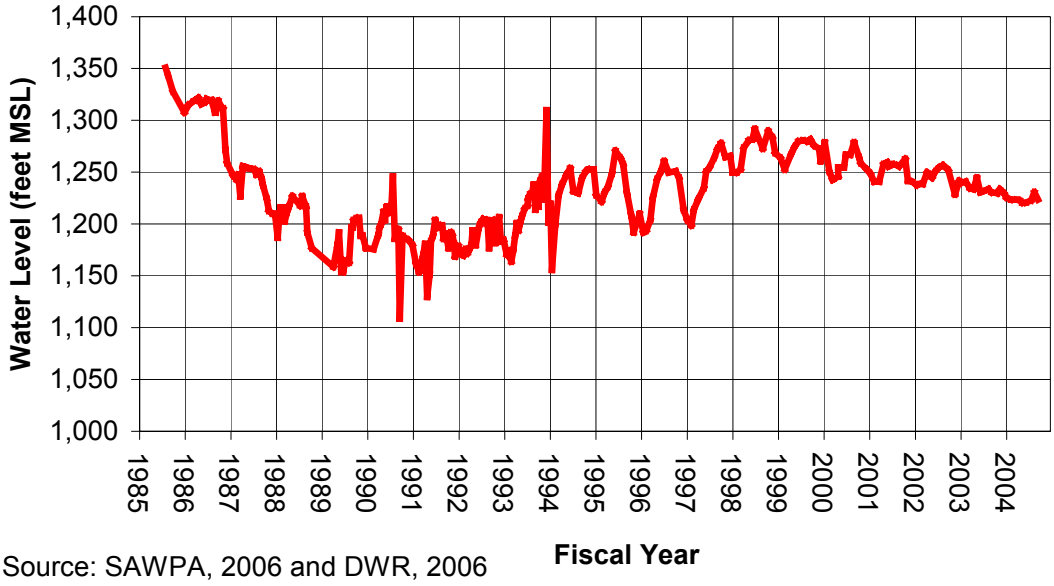
Historical groundwater levels are shown in **Figure 12-8**. As shown in this figure, water levels have dropped more than 150 feet between fiscal year 1985/86 and 2004/05. However, the Cucamonga Basin is small and reacts quickly to precipitation and long seasonal pumping (Michael, 1981), water levels are largely dependent upon precipitation. As such, the dry period between 2000 and 2004 is reflected in the water levels.

**Figure 12-7**
**Areas of Subsidence in the Chino Basin (1996 to 2000)**




Source: Wildermuth, 2006

**Figure 12-8**
**Historical Water Levels in the Cucamonga Basin**




Source: SAWPA, 2006 and DWR, 2006

## GROUNDWATER QUALITY

The following provides a brief description of the groundwater quality issues for the Chino and Cucamonga Basins.

### Groundwater Quality Monitoring

Historically, groundwater quality data in the Chino Basin were collected by various entities. In 1990, Watermaster initiated a regular monitoring program for Chino Basin. Subsequent to the initial monitoring program, Watermaster developed the OBMP in 1999, and the Peace Agreement that implemented the OBMP in 2000.

The OBMP established goals for the Chino Basin Watermaster, beginning with the Comprehensive Water Quality Monitoring Program (CMP), which included water quality sampling and analysis from all known active production and monitoring wells in the Chino Basin (from 1999 to 2001). Subsequently, the Groundwater Monitoring Program has continued to provide an evaluation of water levels and water quality for the Chino Basin (Wildermuth, 2005a).

The Chino Basin Watermaster and IEUA have an agreement to share in the monitoring efforts in the basin with the intent of minimizing the cost of data acquisition, laboratory services, and data management. The types of data being collected in the cooperative program include surface water quality at recharge basins, surface water quality in the Santa Ana River, soil water samples from lysimeters at recharge basins, groundwater quality, groundwater level, and surface water discharge measurements in the Santa Ana River. Chino Basin Watermaster will complete most of the fieldwork and IEUA will do most of the analytical work at their laboratory (Wildermuth, 2005a).

Programs to monitor groundwater levels and water quality have been reorganized to better support new initiatives. These include such projects as subsidence management in the western portion of the Chino Basin, hydraulic control monitoring, nitrogen loss, and desalter expansion. Automatic measuring and recording devices are increasingly being used to replace manual sampling. These automatic data loggers lower costs, improve accuracy and provide better data. These include three active groundwater-monitoring programs:

1. Semiannual Basin-Wide Monitoring Program in which Watermaster manually measures water levels in about 480 agricultural wells twice each year to determine the effects of production on groundwater levels.

2. Intensive Key Well Program associated with the desalter activities and the Hydraulic Control Monitoring Program. Launched in 2003-04, the Key Well Program involves about 107 wells.

3. MZ-1 Monitoring Program transitions to Long-Term Planning. Using a series of standard monitoring wells as well as sophisticated piezometric monitors and infrared satellite imagery, Watermaster has been monitoring the western portion of the Basin.

The focus is on looking ahead to a long-range plan to understand and prevent any ground subsidence due to changes in groundwater levels. Related to this are cooperative aquifer stress tests that measure water production versus groundwater levels, conducted in cooperation with the cities of Chino and Chino Hills.

Chino Basin Watermaster, IEUA, Orange County Water District and the Regional Board developed a hydraulic control-monitoring program in 2005 to characterize the relationship of the Santa Ana River and the Chino Basin. Hydraulic control monitoring wells have been constructed and the monitoring program initiated. Information from this program will be use to adaptively manage the Chino Basin storage and recovery programs (IEUA, 2005). In 2004-05, nine new monitoring wells were installed as part of the piezometric monitoring element of the Hydraulic Control Monitoring Program. The new monitoring wells were needed because existing well locations and well construction are not sufficient to measure the extent of hydraulic control near the desalter well fields. They also were needed because of the loss of agricultural well monitoring caused by the conversion of agriculture to urban land uses (Chino Basin Watermaster, 2005).

Chino Basin Watermaster and IEUA are also designating a number of monitoring wells at recharge basins to monitor the influence of recharge on groundwater levels, as well as the changes in water quality resulting from the recharge of storm, imported and recycled water. At least one monitoring well will be installed downgradient of each recharge facility that receives recycled water.

The Santa Ana Watershed Basin Monitoring Task Force is a collaborative effort of public and private sector agencies and interests. As part of this effort, SAWPA compiles water quality data in the Santa Ana River Watershed, including total dissolved solids (TDS) and nitrate (as N) data. SAWPA also prepares a triennial update of the ambient groundwater quality throughout all the groundwater basins in the Santa Ana River Watershed.

**Groundwater Contaminants**

**Table 12-7** provides a summary of the groundwater constituents of concern for the Chino and Cucamonga basins. Each basin's quality is discussed separately. **Figures 12-9 through 12-11** show the distribution of nitrate, total dissolved solids (TDS), and VOCs measured in wells in the Chino Basin (Wildermuth, 2005a).

**Chino Basin**

The following section describes the groundwater quality issues in the Chino Basin. Constituents of concern for the Chino Basin include: TDS, nitrate, VOCs and perchlorate. Each of these constituents is described in more detail below.

TDS concentrations range from less than 250 mg/L to more than 2,000 mg/L in the Chino Basin. TDS concentrations in the northern portion (*i.e.*, north of the 60 Freeway) of the Chino Basin are generally less than 250 mg/L. TDS concentrations in municipal wells south of the 60 Freeway were typically in the range of 250 to 500 mg/L with areas of greater than 2,000 mg/L.

More than 72 percent of private wells had TDS concentrations that exceeded recommended secondary standard of 500 mg/L (Wildermuth, 2005a).

**Table 12-7**
**Summary of Constituents of Concern in the Chino and Cucamonga Basins**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL = 500 | mg/L | **Chino Basin**<br><125 to > 2,000<br>**Cucamonga Basin**<br>163 to 446 | TDS concentrations in the northern portion of the Chino Basin are generally less than 250 mg/L. TDS concentrations south of the 60 Freeway were typically in the range of 250 to 500 mg/L with some areas greater than 2,000 mg/L. More than 72 percent of private wells exceed 500 mg/L.<br>Current average ambient in Cucamonga Basin is approximately 250 mg/L. |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/L | **Chino Basin**<br>Less than 5 to >40<br>**Cucamonga Basin**<br>Up to 25 | Nitrate concentrations generally increase from north to south with levels in wells south of the 60 Freeway commonly exceeding 40 mg/L. 83 percent of private wells exceed the nitrate MCL.<br>Current average ambient nitrate in Cucamonga Basin is approximately 4.3 mg/L. |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL for TCE = 5<br>Primary MCL for PCE = 5 | µg/L | **Chino Basin**<br>ND to > 20 for TCE<br>ND to >20 for PCE<br>**Cucamonga Basin**<br>ND | In general, PCE and TCE are below detection limits for wells in the Chino Basin. Isolated pockets of TCE and PCE are noted.<br>PCE and TCE are not detected in the Cucamonga Basin. |
| **Perchlorate**<br>Notification level = 6 | µg/L | **Chino Basin**<br>ND to > 34<br>**Cucamonga Basin**<br>ND to 6 | Perchlorate has been detected above notification level in 128 wells in the Chino Basin. Concentrations below action levels have been detected in the Cucamonga Basin. |
| **DBCP**<br>Primary MCL = 0.2 | µg/L | **Cucamonga Basin**<br>ND to 1 | Wells are currently blended in Cucamonga Basin. Concentrations since 1990 have ranged from ND to 1 µg/L. |

Source: Wildermuth, 2005a,b

**Figure 12-9**
**Total Dissolved Solids in Groundwater - Chino Basin (1999-2004)**

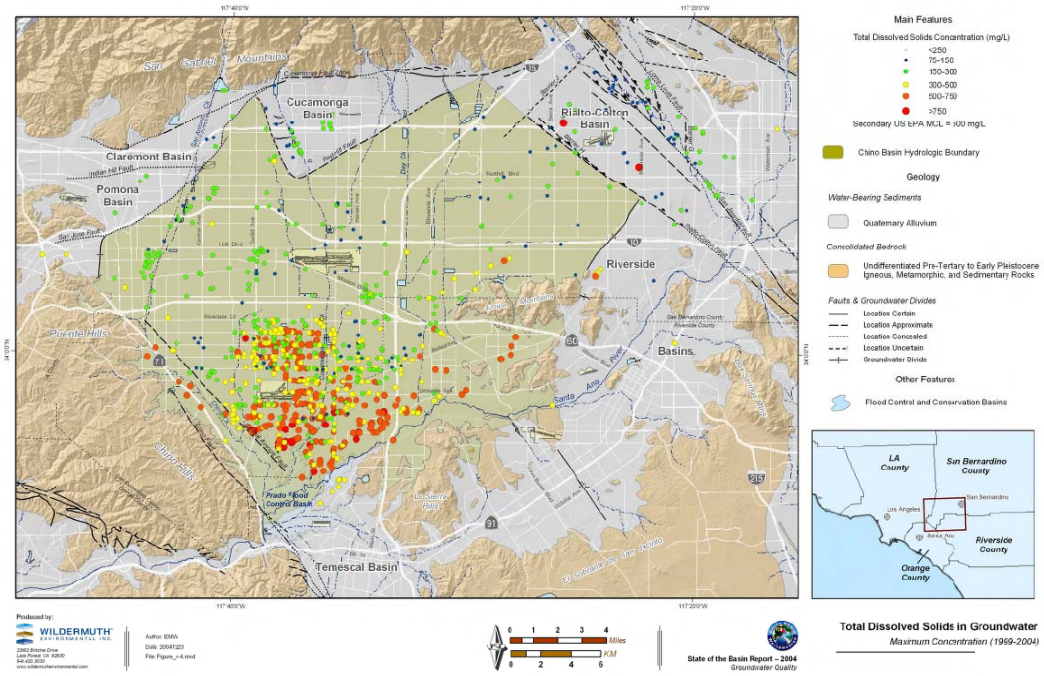



**Figure 12-10**
**Nitrate (as N) in Groundwater - Chino Basin (1999-2004)**

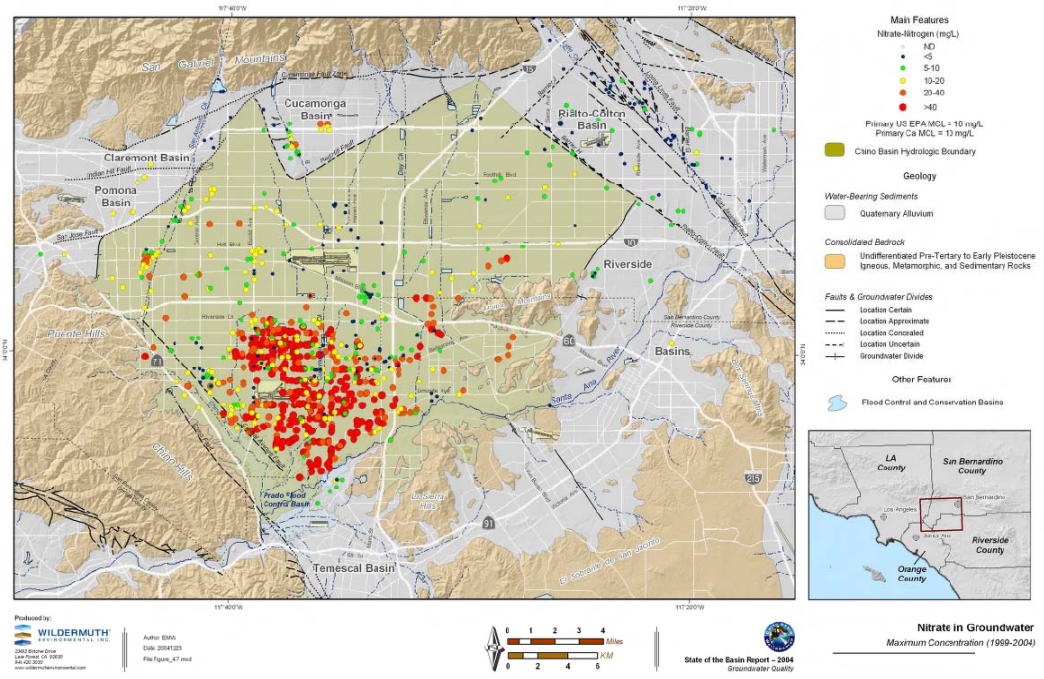
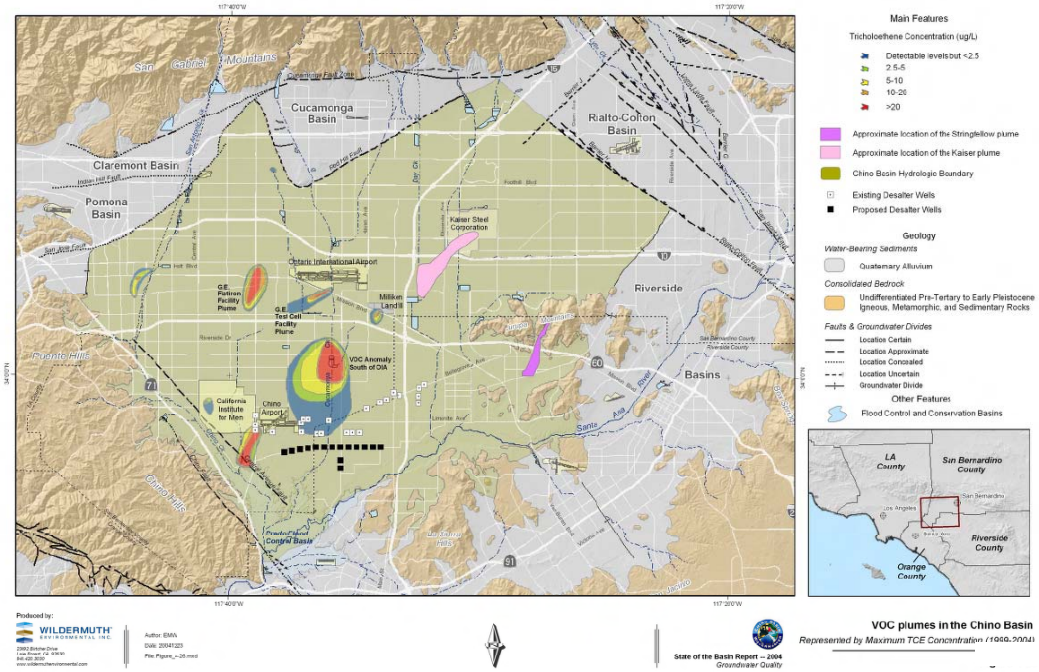


**Figure 12-11**
**Location of VOC Plumes in the Chino Basin (1999-2004)**




There are various locations where nitrate exceeds the maximum contaminant level (MCL) of 10 mg/L for nitrate (as N). Nitrate concentrations in the Chino Basin generally increase from north to south within the basin. North of the 10 Freeway, nitrate levels are generally less than 10 mg/L. Wells measured in the area south of the 10 Freeway and north of the 60 Freeway contain concentrations of nitrate that range from non-detect to 40 mg/L. South of the 60 Freeway nitrate concentrations are predominantly greater than the maximum contaminant level (MCL) of 10 mg/L with many wells exceeding 40 mg/L (Wildermuth, 2005b). The results from a 2002 and 2003 study indicate that about eighty-three percent of the private wells had nitrate concentrations greater than the MCL and 60 percent are more than 2.5 times greater than the MCL (Wildermuth, 2005a)

In general, PCE and TCE concentrations are below detection limits for wells in the Chino Basin. The wells with detectable levels tend to occur in clusters such as those seen around Milliken Landfill, south and west of the Ontario Airport and along the margins of the Chino Hills (Wildermuth, 2005a). The areas are discussed in more detail with respect to treatment below.

Perchlorate has been detected above the notification level of 6 µg/L in 128 wells in the Chino Basin (IEUA, 2005) in the period between 1999 and 2004. Historical values of perchlorate exceeding the State Notification Level have occurred in the Fontana area, downgradient of the Stringfellow Superfund Site (concentrations have exceeded 600,000 µg/L in on-site observation wells), City of Pomona, City of Ontario south of the Ontario Airport, and in scattered wells throughout Chino Basin.

#### Cucamonga Basin

For the Cucamonga Basin, water sampled from 23 public supply wells have TDS concentrations that range from 163 mg/L to 446 mg/L with an average of 261 mg/L (DWR, 2004). Average ambient TDS calculated by Wildermuth (2005b) was slightly lower at 250 mg/L.

Six of CVWD's seventeen active wells contain high concentrations of nitrate and dibromochloropropane (DBCP). Concentrations of DBCP in CVWD wells since 1990 range from ND to 1 µg/L, which is above the MCL of 0.2 µg/L. Current average ambient nitrate (as N) in Cucamonga Basin is approximately 4.3 mg/L (Wildermuth, 2005b). Low levels of perchlorate have also been found in some wells (CVWD, 2005).

### Blending Needs

#### Chino Basin

No data related to blending in Chino Basin are available at this time.

#### Cucamonga Basin

In Cucamonga Basin, other wells are used to blend down concentrations of key constituents. Wells that contain concentrations of nitrate and DBCP greater than the MCLs are blended to reduce the concentrations to levels that meet standards. Water in some wells containing perchlorate is also blended with other groundwater (CVWD, 2005). CVWD has developed operational blending plans so that wells within the Cucamonga Basin can continue to provide potable water. The well blending plans were approved by the DHS.

### Groundwater Treatment

#### Chino Basin

To address the water quality issues described above, there are various groundwater treatment facilities online in the Chino Basin.

In the Chino Basin, various groundwater contaminant plumes are treated at on-site remediation facilities. As shown in **Figure 12-11**, identified plumes of contaminated groundwater from past industrial operations include: the GE Flatiron Facility, GE Test Cell Facility, Ontario Airport, Kaiser Steel Corporation, Milliken Landfill, California Institute for Men, Upland Landfill, Stringfellow and Chino Airport plumes. Treatment details are summarized in **Table 12-8**. Desalter facilities, including Chino I and Chino II, as discussed above, treat TDS and nitrate-impacted groundwater in the southern portion of the basin. The details of the desalters are included in **Table 12-8** below.

Additional ion exchange wellhead treatment is also included as part of the Chino Basin conjunctive use program (discussed below) with Metropolitan. These facilities are currently under construction and are not yet operational. Actual capacities and amount treated are not known at this time.

**Table 12-8**
**Summary of Groundwater Treatment in the Chino Basin**

| Treatment Facility | Constituent Treated | Treatment Type | Amount Treated | Comments |
|---|---|---|---|---|
| Upland Landfill | VOCs | None | None | No treatment due to low concentration. |
| GE Flatiron Facility | TCE | GAC | 0.8 MGD (1996-2004) | One extraction well began operation in 1996. A second extraction well began operation in 2004. |
| | Hexavalent chromium chromate | Ion Exchange | 1.2 MGD (2004-present) | |
| GE Test Cell Facility | TCE Other VOCs | None | None | Treatment expected to start by early 2008. Plume is stable and not moving. |
| Milliken Landfill | VOCs | Aeration Tower | 4,000 gallons per day | Treatment started in 2003. Plume contained on landfill site. |
| California Institute for Men | PCE | Air Stripping | None | Air stripping was used to remove PCE from a water supply well from 1997 until 2004. PCE concentrations diminished, and there has been no treatment since 2004. Ongoing treatment consists of using groundwater for crop irrigation. |
| Kaiser Steel | TDS VOCs | None | None | No treatment due to low concentrations. |
| Chino Airport | TCE | None | None | Remedial investigation in progress. Treatment may begin in 2008/2009. |
| VOC Anomaly South of Ontario International Airport | TCE Perchlorate | None | None | Site assessment and remedial investigation beginning. Not known when treatment will start. |
| Stringfellow Superfund Site | VOCs | GAC | 10,000 gallons per month | VOCs largely remediate. |
| | Metals | Precipitation | 10 – 20 gpm | Metals captured at existing treatment plant. |
| | Perchlorate | Ion Exchange and/or Bio-remediation | None | California Department of Toxic Substances Control has characterized the contamination and is conducting the feasibility study. The Record of Decision is expected by December 2009. Plume appears to extend to the Santa Ana River. |

**Table 12-8 (continued)**
**Summary of Groundwater Treatment in the Chino Basin**

| Treatment Facility | Constituent Treated | Treatment Type | Amount Treated | Comments |
|---|---|---|---|---|
| Chino I Desalter | TDS<br>Nitrate<br>VOCs | Reverse Osmosis<br>Ion Exchange<br>Air Stripping | Up to 15,900 AFY | Online in 2000<br>Average of 7,900 AFY treated. |
| Chino I Desalter | TDS<br>Nitrate | Reverse Osmosis<br>Ion Exchange | Up to 10,200 AFY | Online in 2006. |

Source: Regional Board, 2007; IEUA, 2006b; Chino Desalter Authority, 2005; Chino Basin Watermaster, 2007a; DTSC, 2006; DTSC, 2007.

### Cucamonga Basin

The active wells in the Cucamonga Basin are operated in accordance with a DHS-approved blending plan. Concentrations of contaminants are not expected to increase from current levels, and well-head treatment systems have not been installed (CVWD, 2005).

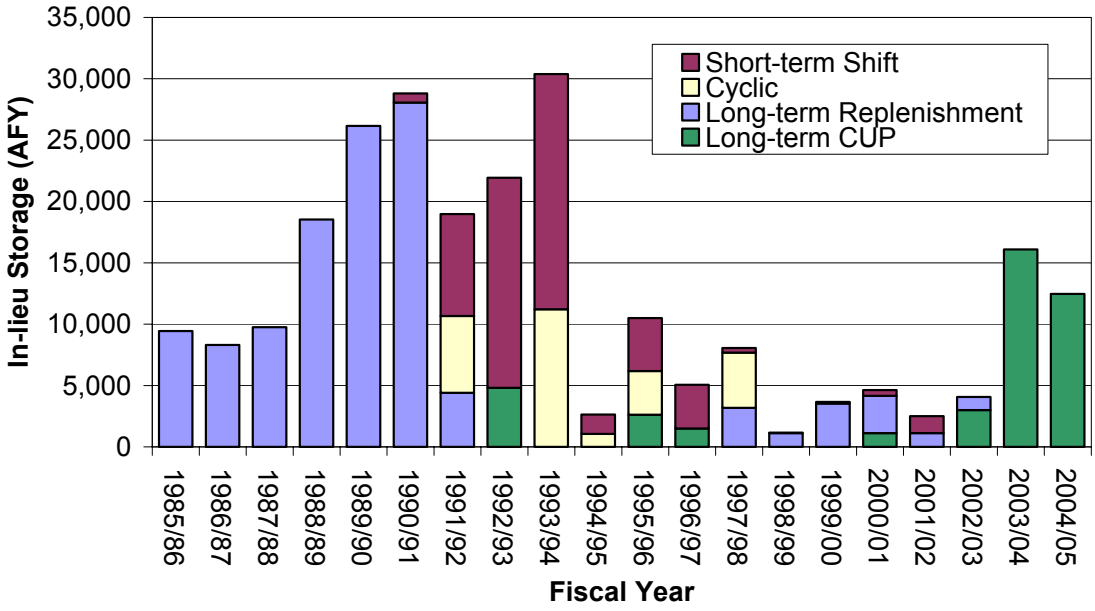
## CURRENT GROUNDWATER STORAGE PROGRAMS

In 2003, the Chino Basin Watermaster, Three Valleys Municipal Water District, and IEUA executed a conjunctive use program (also referred to as the Dry Year Yield Program, DYY or CUP) with Metropolitan. The Chino CUP provides for a 100,000 AF storage account in the Chino Basin. Upon a call by Metropolitan, program participants will extract up to 33,000 AFY in lieu of receiving deliveries at a Metropolitan service connection. The program provides funding for development of facilities needed for extraction of stored water. As of June 30, 2005, the stored account balance in the CUP account was approximately 59,000 AF.

In addition, the Chino Basin producers have participated in a variety of other groundwater storage programs with Metropolitan since 1985. These include Metropolitan's cyclic and replenishment water programs for purchase of imported water for spreading and in-lieu. Direct recharge volumes are discussed above. In-lieu deliveries are summarized in **Figure 12-11**. In-lieu programs include: short-term shift, cyclic, long-term replenishment, and the long-term CUP storage account (programs such as cooperative storage and trust accounts have been rolled into the CUP storage account).

No groundwater storage programs currently exist within the Cucamonga Basin.

**Figure 12-12**
**In-lieu Storage in Chino Basin**




## BASIN MANAGEMENT CONSIDERATIONS

The following describes general management considerations that affect the use of groundwater in the Chino and Cucamonga Basins.

Considerations in the Chino Basin include:

- TDS and nitrate concentrations predominantly in southern portion of basin and several large VOC plumes are significant issues for the basin.
- There are no court-ordered limits on pumping by groundwater users. However, pumping in excess of safe yield must be replenished.
- Desalters are used to maintain hydraulic control and protect Santa Ana River water quality.
- Recent increased use of recycled water has increased management flexibility.
- Subsidence and fissuring could limit production in the deep aquifer of southwestern portion of basin.

Considerations in the Cucamonga Basin include:

- Groundwater pumping from the Cucamonga Basin is limited by the 1958 Superior Court stipulated judgment to 22,721 AFY (CVWD, 2005).

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# CHAPTER IV

# GROUNDWATER BASIN REPORTS

# EASTSIDE METROPOLITAN SERVICE AREA BASINS

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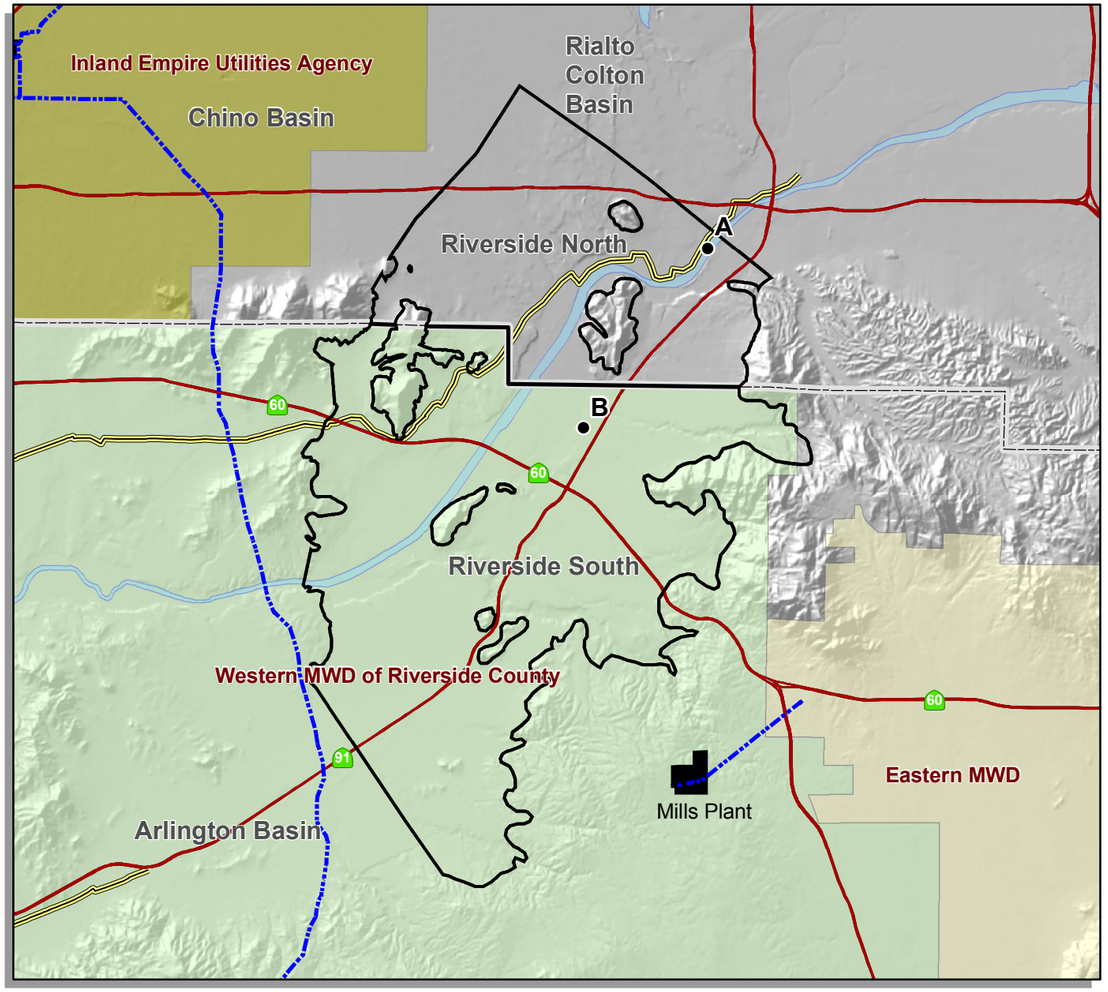


## Riverside Basin

A ● Key Well
County
Freeways
Water Body
MWD Pipeline
MWD Facilities
Santa Ana Regional Interceptor Line
Basin
MWD Member Agency Boundary (color varies)

N W E S

3 1.5 0 3 Miles

Note: This map was prepared by the Metropolitan Water District of Southern California for its own use. No warranty is expressed or implied as to the correctness, timeliness, or content of the information shown herein.

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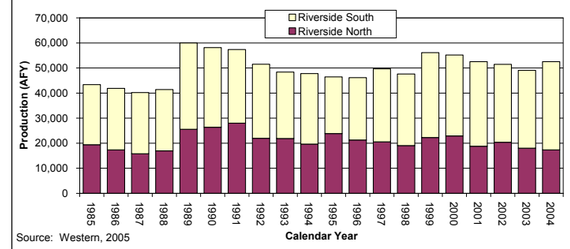
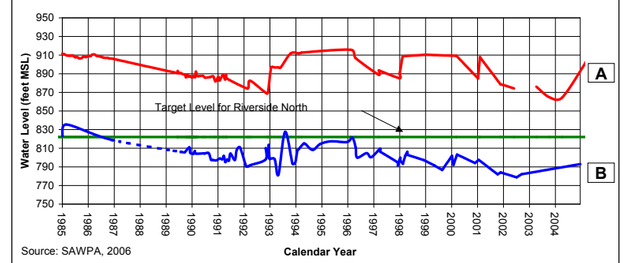
Additional Data Sourse(s): Santa Ana Watershed Project Authority (SAWPA); California Spatial Information Library (CaSIL).

## Production



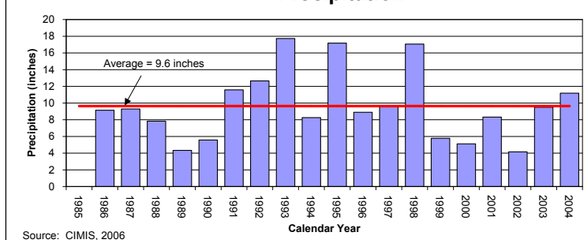

Source: Western, 2005

## Water Level




Source: SAWPA, 2006

## Precipitation




Source: CIMIS, 2006

## Direct Groundwater Recharge

No direct groundwater recharge data available for this basin.

## BASIN FACTS

### Riverside Basin

**Description**
**Location:** Riverside County and San Bernardino County
**Watershed Surface Area:** 36 square miles
**Subbasins:**
Riverside North
Riverside South
**Management:** Adjudicated
Although production is not limited, maintaining of water levels in Riverside North is included in 1969 San Bernardino Judgment
**MWD Member Agencies:**
Western MWD

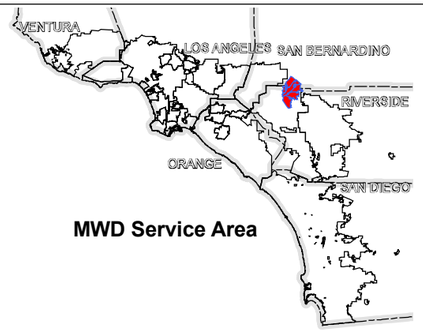
| | Riverside North | Riverside South |
|---|---|---|
| **Natural Safe Yield** | 33,729 AFY | 29,633 AFY |
| **Total Storage** | 1.15 million AF | |
| **Unused Storage Space (Fall 2003)** | 427,000 AF | |
| **Portion of Unused Storage Space Available for Storage** | Unknown | |

**Storage and Extraction Facilities**

| | Riverside North | Riverside South |
|---|---|---|
| **Production Wells** | | |
| Production Capacity | ~30,000 AFY | ~54,000 AFY |
| Average 1985-2004 | 20,690 AFY | 28,971 AFY |
| **Injection Wells** | | |
| Injection Capacity | None | None |
| Average 1985-2004 | None | None |
| **Spreading Basins** | | |
| Spreading Capacity | None | None |
| Average 1985-2004 | None | None |

**Basin Management Considerations**

- Water quality (TDS, nitrate, perchlorate, TCE, PCE and DBCP) could limit ability to store and extract water
- Maintaining water levels in Riverside North is required by SBVMWD




**MWD Service Area**

**Plate 13-1**
**Overview of Riverside Basin**

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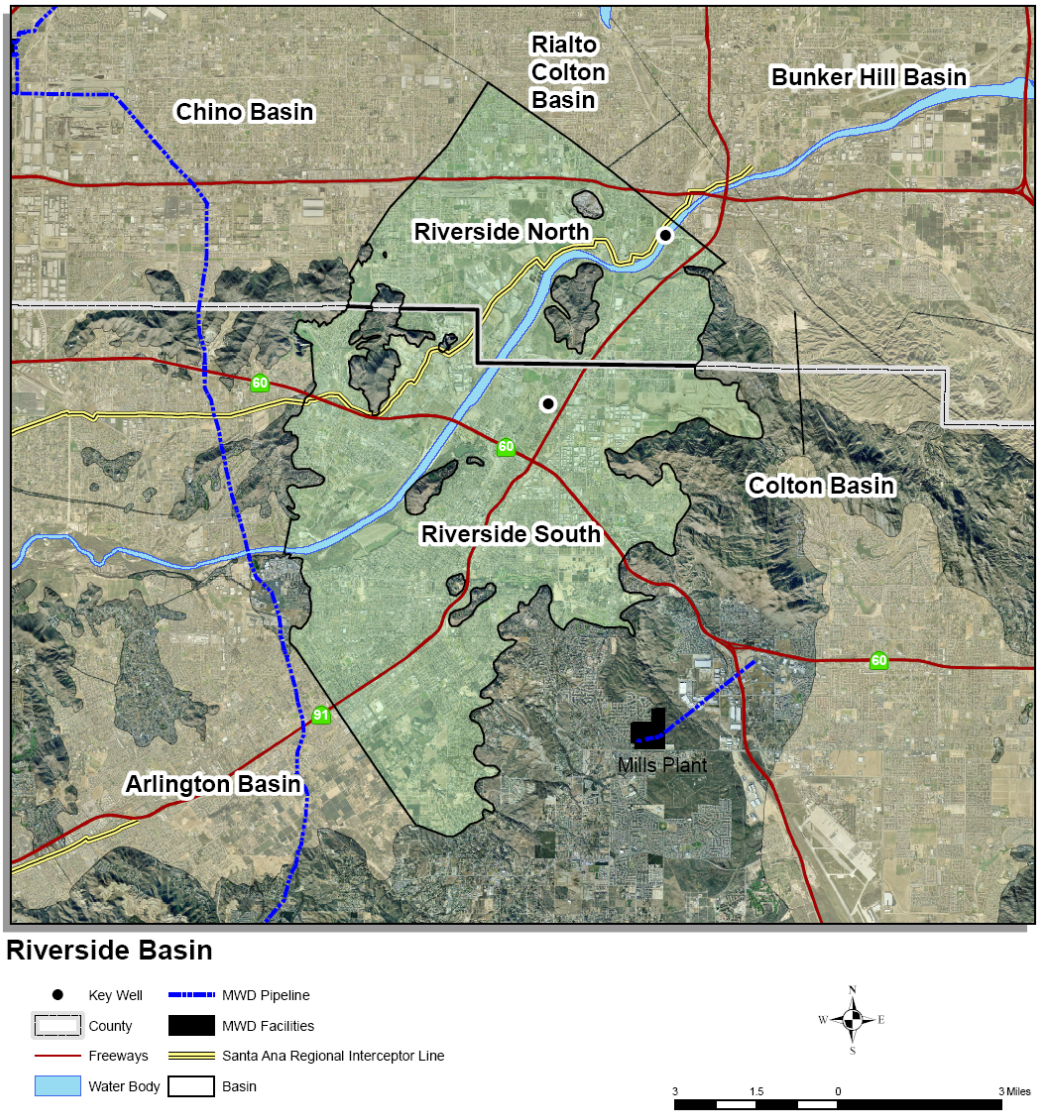
The Riverside Basin, located in northwestern Riverside County and southwestern San Bernardino County, includes the Riverside North and Riverside South subasins. The Riverside North Basin includes the portion of the Riverside Basin located in San Bernardino County, which is within the service area of the San Bernardino Valley Municipal Water District (SBVMWD), and the Riverside South Basin, which is located within the service area of Western Municipal Water District (Western MWD), includes the portion in Riverside County. This division is strictly administrative and does not reflect a physical barrier to groundwater flow between the subasins. The Riverside Basin includes the community of Riverside and unincorporated areas of Riverside County. The location and key facilities of the Riverside Basin are shown in **Figure 13-1**.

**Figure 13-1**
**Map of the Riverside Basin**



## BASIN CHARACTERIZATION

The following section provides a physical description of the Riverside Basin including its geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

The Riverside Basin, which follows the course of the Santa Ana River, is a large alluvial fill basin that is bounded by major faults and topographic barriers. The northeast boundary is formed by the Rialto-Colton fault, and a portion of the northern boundary is a groundwater divide. The Santa Ana River flows over the northern portion of the basin (DWR, 2004). Alluvial deposits in the basin consist of sand, gravel, silt, and clay deposited by the Santa Ana River and its tributaries. Near the city of Riverside, the upper 50 feet of deposits are principally clay. At the northern end of the basin, coarser gravels with cobbles 4 to 6 inches in diameter are common (DWR, 2004). As discussed above, the Riverside Basin is divided into the Riverside North and Riverside South for administrative purposes; there are no groundwater barriers or physical divides between these subbasins within the Riverside Basin. The hydrogeologic parameters for the Riverside Basin are summarized in **Table 13-1**.

Groundwater occurrence is generally unconfined in the Riverside Basin. Maximum aquifer depth in the Riverside North Basin ranges from about 600 to 700 feet and more than 400 feet in the Riverside South Basin, with water bearing units comprised of sand and gravel deposits (Riverside, 2005a). The total estimated groundwater storage capacity in the Riverside Basin is approximately 1.15 million AF (Wildermuth, 2006). In the fall of 2003, it is estimated that approximately 427,000 AF was unused (Wildermuth, 2006). However, because the upper 50 to 100 feet of unsaturated thickness cannot generally be used because of issues such as increased liquefaction potential, not all of the storage space identified can be used for storage. The usable storage in the Riverside Basin is unknown.

### Safe Yield/Long-Term Balance of Recharge and Discharge

Recharge to the basin occurs via infiltration of flow from the Santa Ana River and unlined channels, underflow from saturated alluvium and fractures within the surrounding bedrock hills, underflow as seepage across the Rialto-Colton fault and percolation of precipitation and returns from use. About 1/3 of the inflows to the basin (about 20,000 AFY) come from underflow across the Rialto-Colton fault (Riverside, 2005a). Safe yield of the combined Riverside Basin is approximately 63,362 AFY (Riverside, 2005a).

Precipitation recharge is a relatively small component of the water budget for the Riverside Basin. Average precipitation is 9.6 inches per year. **Figure 13-2** provides the historical precipitation data from the CIMIS Riverside #44 Station located near UC Riverside (CIMIS 2006). These data suggest below average precipitation between 1986 and 1990 and 1999 and 2003, above average precipitation between 1991 and 1998 and since 2004.

**Table 13-1**
**Summary of Hydrogeologic Parameters of Riverside Basin**

| Parameter | Description |
|---|---|
| **Structure** | |
| Aquifer(s) | Unconfined alluvium |
| Depth of groundwater basin | 0 to 700 feet |
| Thickness of water-bearing units | Riverside North: 600 to 700 feet<br>Riverside South: at least 400 feet |
| **Yield and storage** | |
| Natural safe yield | Riverside North: 33,729 AFY [1]<br>Riverside South: 29,633 AFY [1]<br>Total: 63,362 AFY [1] |
| Total Storage | 1,149,000 AF |
| Unused Storage Space (Fall 2003) | 427,000 AF |
| Portion of Unused Storage Space Available for Storage | Unknown |

Source: Riverside, 2005a ;DWR, 2004; and Wildermuth, 2006
[1]1959-63 base period average extraction as verified by the Watermaster

## GROUNDWATER MANAGEMENT

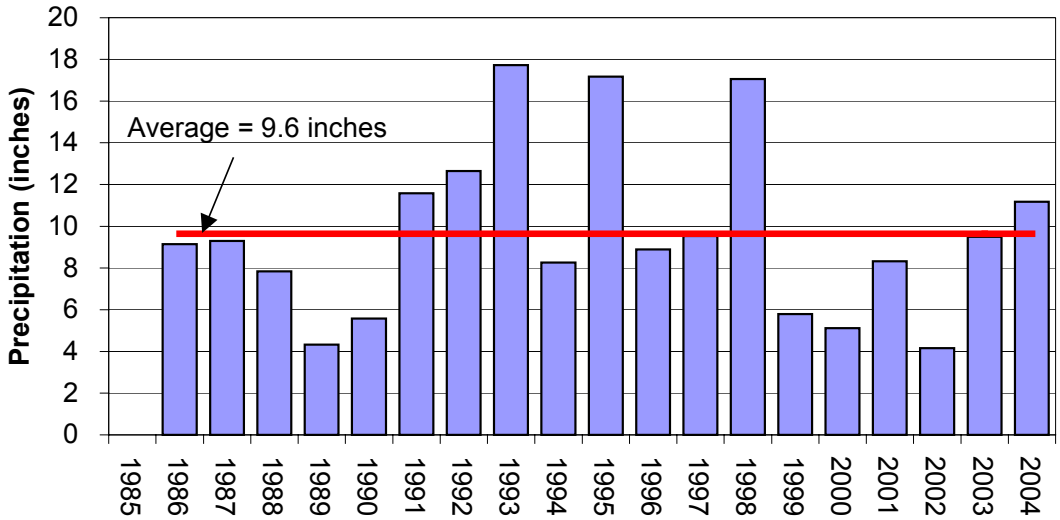
The following section describes how the Riverside Basin is currently managed. This description includes a description of the governing structure and agreements pertaining to adjoining basins.

### Basin Governance

The Riverside Basin is adjudicated. The Riverside Basin is included in the 1969 Stipulated Judgment No. 78426, Western Municipal Water District of Riverside County et al. versus East

San Bernardino County Water District, et al, Superior Court of the State of California for Riverside County (1969 Judgment). The 1969 Judgment distinguishes the portions of Riverside

**Figure 13-2**
**Historical Precipitation in the Riverside Basin**




Source: CIMIS, 2006
Riverside #44

Basin in San Bernardino and Riverside counties sets out the average annual extraction for each portion of the Riverside Basin and establishes a watermaster to administer and enforce the judgment provisions. Extraction from the San Bernardino County portion for use *outside* San Bernardino Valley and from the Riverside County portion of the basin, without replenishment obligation, are limited within any 5 consecutive year period to 5 times the annual average extraction during the 1958-63 base period. Replenishment is required if the extraction in any year is 20 percent more than the annual average in a basin portion. Extractions from the Riverside Basin within San Bernardino County for use *within* San Bernardino Valley are not limited except that static water levels in the area shall not fall below a specified water elevation. The 1969 Judgment specifies that it does not limit rights to spread, store and recapture imported water.

**Table 13-2** provides a list of managing agencies in the Riverside Basin.

**Interactions with Adjoining Basins**

As discussed above, the Rialto-Colton fault to the northeast separates the Riverside Basin from Rialto-Colton Basin. The fault is a barrier to groundwater flow along of its length, especially in its northern reaches (Wildermuth 2000). A groundwater divide in the alluvium separates the Riverside Basin from the Arlington Basin to the south (DWR, 2004). In addition, groundwater beneath the Santa Ana River in the western portion of the Riverside Basin rises to become

surface water within the Santa Ana River upstream of Riverside Narrows and flows into the Chino Basin. There are no agreements that govern the flow into Chino Basin.

The Riverside Basin is tributary to the Santa Ana River upstream of Prado Dam. On April 17, 1969, the Orange County Superior Court entered a Stipulated Judgment in Case No. 117628 involving the Orange County Water District vs.City of City of Chino et al (Santa Ana River Judgment). The Santa Ana River Judgment, which became effective October 1, 1970, contained a declaration of rights of the entities in the lower Santa Ana River area (i.e. OCWD) versus those in the upper Santa Ana River area (i.e. San Bernardino Valley Municipal Water District, or SBVMWD, Chino Basin MWD, now called IEUA, and Western MWD).

**Table 13-2**
**Summary of Management Agencies in the Riverside Basin**

| Agency | Role |
|---|---|
| San Bernardino Valley Municipal Water District | Co-Watermaster for 1969 Judgment<br>Part of Watermaster Committee responsible for administration of 1969 Santa Ana River Judgment. |
| Western Municipal Water District (Western MWD) | Co-Watermaster for 1969 Judgment<br>Part of Watermaster Committee responsible for administration of 1969 Santa Ana River Judgment. |
| San Ana River Watermaster | Watermaster for 1969 Stipulated Judgment that defined water allocations in the Santa Ana River among lower Santa Ana River and upper Santa Ana River producers. |
| Santa Ana Water Project Authority (SAWPA) | Joint Powers Authority established to plan and build facilities to protect the water quality of the Santa Ana River Watershed. |
| California Regional Water Quality Control Board – Santa Ana Region (Regional Board) | Issuance of permits for discharges to Santa Ana River |
| Cities of Colton and San Bernardino | Operation of Rapid Infiltration and Extraction (RIX) facility |

The Judgment is administered by the Santa Ana River Watermaster, a committee of five members (one each from SBVMWD, IEUA and Western MWD and two from OCWD). Under this Judgment, purveyors upstream of Prado Dam, have the right to use all surface and groundwater supplies originating above Prado Dam without interference from water purveyors downstream of Prado Dam, provided that the average adjusted base flow at Prado Dam is at least 42,000 AFY. Baseflows have ranged from approximately 38,000 AFY in 1970 to approximately 170,000 AFY in 2002. (Santa Ana River Watermaster, 2003). SBVMWD has an obligation to ensure an average annual adjusted base flow of 15,250 AFY at Riverside Narrows. IEUA and Western MWD have a joint obligation to ensure average annual adjusted base flow of

42,000 AFY at Prado Dam. In addition, SBVMWD, IEUA and Western MWD are prohibited from exporting water from the lower area to the upper area while OCWD is prohibited from exporting water or causing water to from the upper area to the lower area (Santa Ana River Watermaster, 2003).

## WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Riverside Basin. Facilities include about 100 active production wells and the RIX facility in Colton.

### Active Production Wells

There are currently about 100 active production wells (both agricultural and municipal) in the Riverside Basin. A summary of the production from these wells is provided in **Table 13-3**. Average production between 1985 and 2004 was approximately 49,661 AFY and presented in **Figure 13-3**. Based upon the past 5 years of production, the estimated production capacity is about 84,000 AFY.

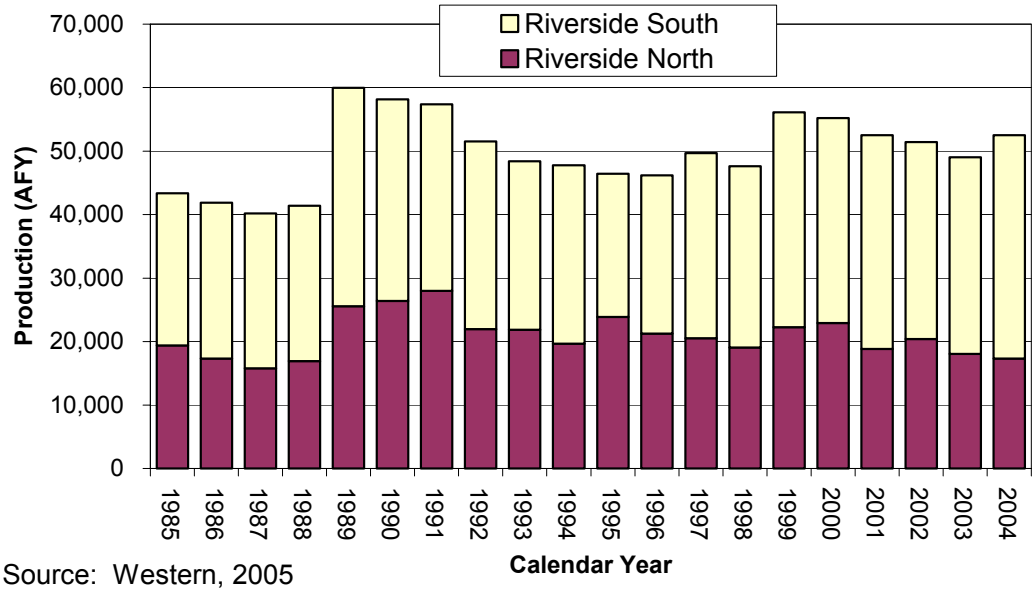
**Table 13-3**
**Summary of Production Wells in the Riverside Basin**

| Category | Number of Active Wells [1] | Estimated Production Capacity [2] (AFY) | Average Production 1985-2004 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| Riverside North | 43 | 30,000 | 20,690 | Not available |
| Riverside South | 57 | 54,000 | 28,971 | |
| **Total** | **100** | **84,000** | **49,661** | |

Source: Western, 2005
1. Active wells have production within past 5 years
2. Estimated production capacity is based upon maximum annual production rate for each well in past 5 years.

Like many water systems in Southern California, Riverside's water system is aging. Many critical elements have exceeded their service life span and are in need of repair and/or replacement. A consultant hired by the City of Riverside recommended about $139 million (2004 dollars) of capital improvement facilities to address water system distribution needs over the next 20 years (MWH, 2005).

**Figure 13-3**
**Historical Groundwater Production in the Riverside Basin**




Source: Western, 2005

## Other Production

In the 1990s, the cities of San Bernardino and Colton were required by the Regional Board to upgrade the quality of their wastewater discharges to the Santa Ana River to meet certain established discharge standards. In cooperation with SAWPA, and with the approval of the Regional Board, a wastewater treatment plan using the tertiary treatment process known as Rapid Infiltration and Extraction (RIX) was constructed in the city of Colton in the Riverside North Basin and placed into service in 1995. In this process, secondary treated wastewater from the two cities' treatment plants is applied to a series of percolation basins. As wastewater percolates through the soil, physical and biological treatment occurs removing many harmful pollutants from the wastewater. After the water infiltrates approximately 15 feet deep, the treated wastewater is extracted through shallow wells surrounding the basins, treated by ultraviolet radiation for disinfection purposes and discharged to the Santa Ana River. Currently, about 37,000 AFY of secondary effluent is percolated at RIX (Wildermuth, 2006). The current permit for RIX requires a certain amount of overextraction to contain percolated effluent. This overextraction is native groundwater from the Riverside Basin and currently (December 2006) equals about 20 percent of the volume of percolated effluent, or about 7,800 AFY. A portion of the treated water that is discharged from RIX percolates back into the Riverside Basin from the Santa Ana River. Between 1995 and 2004, an average of about 9,000 AFY of groundwater was over-extracted from the Riverside North Basin by the RIX project and discharged into the Santa Ana River (Western MWD, 2005).

**ASR Wells**

There are no ASR wells in the Riverside Basin.

**Spreading Basins**

There are no intentional spreading basins in the Riverside Basin to enhance groundwater recharge. Incidental recharge may occur at the RIX facility and stormwater detention basins throughout the basin

**Seawater Intrusion Barriers**

There are no seawater intrusion barriers in the Riverside Basin.

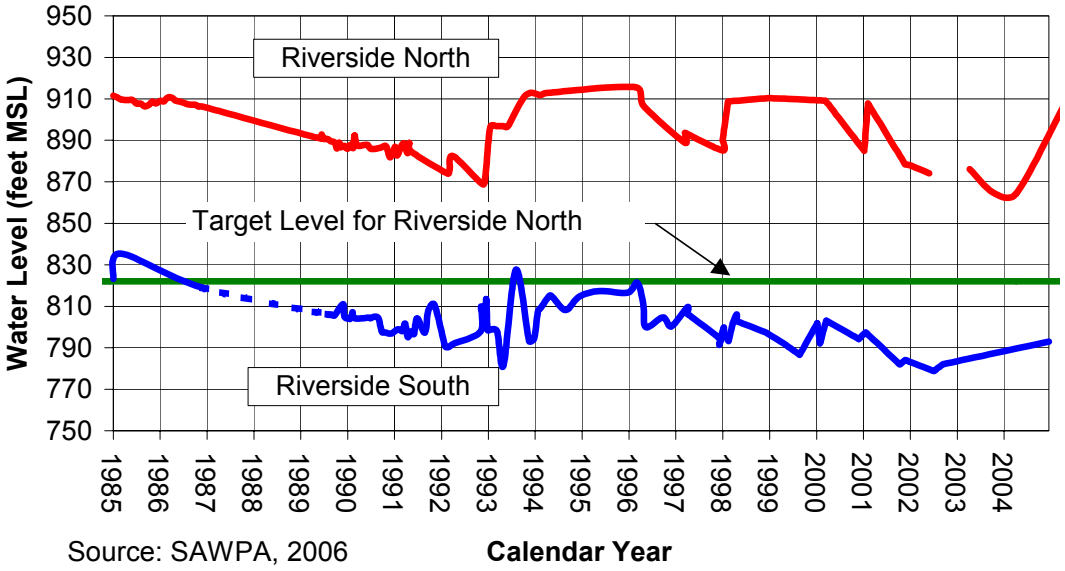
**Desalters**

There are no desalters in the Riverside Basin.

**GROUNDWATER LEVELS**

Groundwater levels in the Riverside North and Riverside South basins are summarized in **Figure 13-4**.

**Figure 13-4**
**Historical Water Levels in the Riverside Basin**




Source: SAWPA, 2006

As discussed above, per the 1969 Judgment, the target level based upon the water level in three specific wells (two in the Riverside North Basin and one in the Colton Basin) is 822.04 feet

MSL. Water levels below the target level trigger replenishment obligations. Between 1985 and 2004, water levels were above this level and remained relatively stable with fluctuations not exceeding 50 feet. Water levels in the Riverside South Basin decreased about 40 feet between 1985 and 2004.

## GROUNDWATER QUALITY

The following provides a brief description of the current water quality of the Riverside Basin. It includes a discussion of current groundwater monitoring activities, contaminants of concern and treatment processes for the region.

### Groundwater Quality Monitoring

Groundwater quality samples are collected from active production wells in accordance with California DHS requirements as specified in Title 22 of the California Code of Regulations.

The Santa Ana Watershed Basin Monitoring Task Force is a collaborative effort of public and private sector agencies and interests. As part of this effort, SAWPA compiles water quality data in the Santa Ana River Watershed, including total dissolved solids (TDS) and nitrate (as N) data. SAWPA also prepares a triennial update of the ambient groundwater quality throughout all the groundwater basins in the Santa Ana River Watershed.

In 2004, the Basin Plan for the Santa Ana Region was amended to incorporate an updated TDS and nitrogen management plan (Regional Board, 2004). For water quality purposes, the Regional Board divided the Riverside Basin into six management zones, defined as Riverside A through Riverside F. These management zone boundaries are shown in **Figure 13-5**.

### Groundwater Contaminants

Constituents of concern for the Riverside Basin include: TDS, nitrate, volatile organic compounds (VOCs) namely trichloroethylene (TCE) and tetrachloroethylene (PCE), perchlorate and dibromochloropropane (DBCP). Descriptions of the range and extent of concentrations in the basin are summarized in **Table 13-4.**

As discussed above, inorganic constituents of concern for the Riverside Basin are TDS and nitrate. As shown in **Figure 13-5**, TDS is generally lower in the northern portion of the basin and increases toward the south. Current ambient TDS concentrations range from 310 mg/L in the Riverside B management zone in the Riverside North Basin to 750 mg/L in the Riverside C management zone of the Riverside South Basin.

Like TDS, as shown in **Figure 13-6**, nitrate (as N) concentrations generally increase from north to south. Average ambient nitrate concentrations range from about 4.6 mg/L in the Riverside A management zone to 15.4 mg/L in the Riverside E management zone. Nitrate (as N) concentrations currently exceed the current MCL of 10 mg/L in management zones C, D, E and F.

**Figure 13-5**
**Ambient TDS Concentrations (1984 to 2003)**

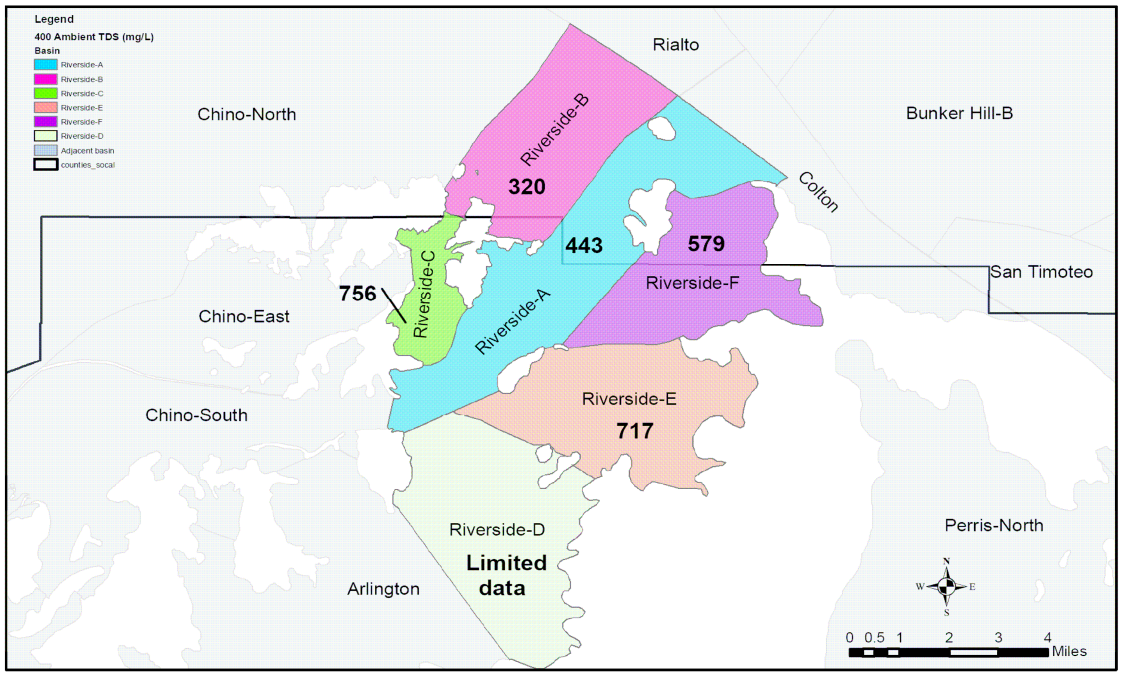
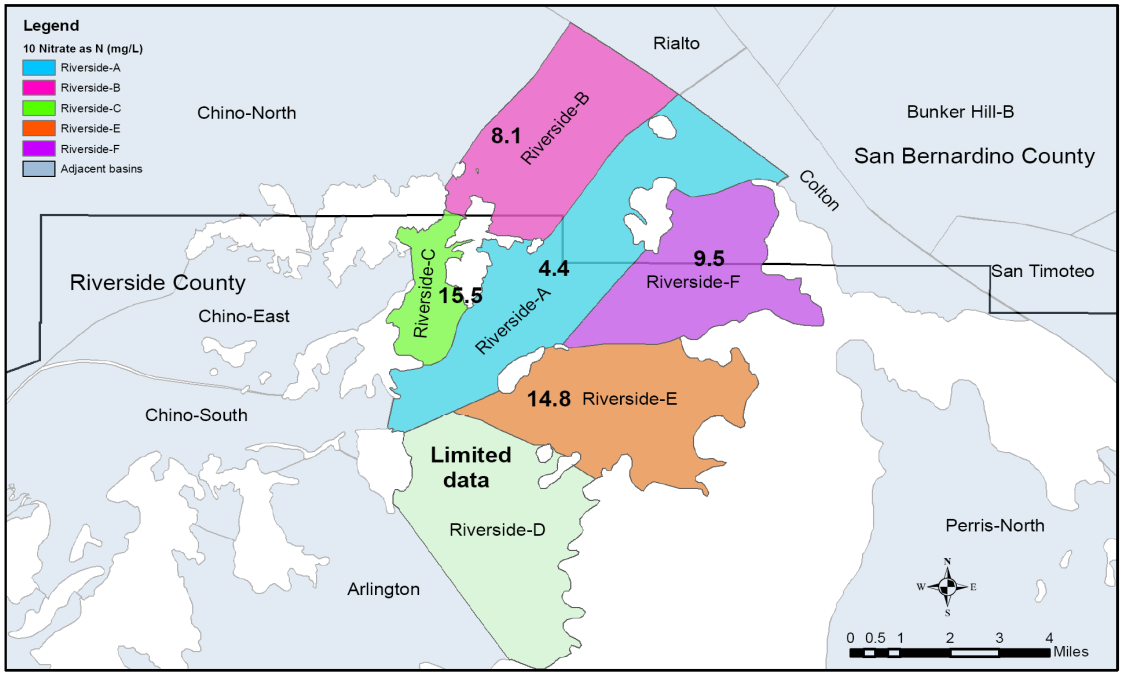



**Figure 13-6**
**Ambient Nitrate Concentrations (1984 to 2003)**




Source: Wildermuth, 2005

**Table 13-4**
**Summary of Constituents of Concern in Riverside Basin**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br><br>Secondary MCL=500 | mg/L | Average Ambient<br>310 to 750 | TDS is generally lower in the northern portion of the basin and increases toward the south. |
| **Nitrate (as N)**<br>Primary MCL =10 | mg/L | Average Ambient<br>4.6 to 15.4 | Like TDS, nitrate concentrations generally increase from north to south. Nitrate concentrations currently exceed the current MCL of 10 mg/L in management zones C, D, E and F. |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL:<br>TCE = 5<br>PCE =5 | µg/L | ND to 52 for TCE<br>ND to 7 for PCE | Seven wells have been impacted by TCE and 15 wells have been impacted by PCE |
| **Perchlorate**<br><br>Notification level =6 | µg/L | Riverside North<br>ND to 5.2<br>Riverside South<br>ND to 23 | Sixteen wells within the Riverside Basin are known to have been impacted by perchlorate, 5 in the Riverside North Basin and 11 in the Riverside South Basin. |
| **DBCP**<br><br>Primary MCL =0.2 | µg/L | Not available | Nature and extent not available at this time |

Source: Wildermuth, 2005, SAWPA, 2006 and Regional Board, 2006

In addition, perchlorate, DBCP, TCE and PCE have also been detected in produced groundwater from the Riverside Basin. Sixteen wells within the Riverside Basin are known to have been impacted by perchlorate, 5 in the Riverside North Basin and 11 in the Riverside South Basin. The perchlorate concentrations range from 4 to 5.2 µg/L in the Riverside North Basin and from 4 to 23 µg/L in the Riverside South basin (Regional Board, 2006).

Seven wells have been impacted by TCE with maximum concentrations of 52 µg/L (MCL of 5 µg/L) and 15 wells have been impacted by PCE with maximum concentrations of 7 µg/L (MCL of 5 µg/L).

**Blending Needs**

Groundwater produced from some wells within the Riverside Basin are treated at the wellhead. In addition, groundwater produced at some wells are blended within transmission mains before

reaching the distribution system. Based upon wells within the City of Riverside's system, about 8 percent of the groundwater produced is blended.

**Groundwater Treatment**

The North Riverside Water Project, which includes two treatment plants and pipeline system, treats groundwater for TCE and DBCP. It was completed in June 2003 (Riverside, 2006). About 30 percent of the groundwater produced in Riverside Basin was treated in 2004/05 (Riverside, 2006; Western MWD, 2005).

## CURRENT GROUNDWATER STORAGE PROGRAMS

There are no current groundwater storage programs in the Riverside Basin.

The City of Riverside currently produces about 18,000 AFY of water from the southern portion of the Riverside Basin and is planning to increase production up to a total of 45,000 AFY in the future. To address the issues associated with increasing groundwater production in the southern portion of the Riverside Basin, Western MWD and the City of Riverside are cooperatively conducting several hydrogeologic studies of the basin.

## BASIN MANAGEMENT CONSIDERATIONS

As discussed above, primary management considerations in the Riverside Basin involve water quality concerns, specifically:

- TDS and nitrate could limit ability to store and extract water
- Perchlorate, TCE, PCE and DBCP contaminants could limit ability to store and extract water

In addition to water quality issues, water levels must be maintained by SBVMWD in the Riverside North Basin per the 1969 Judgment.

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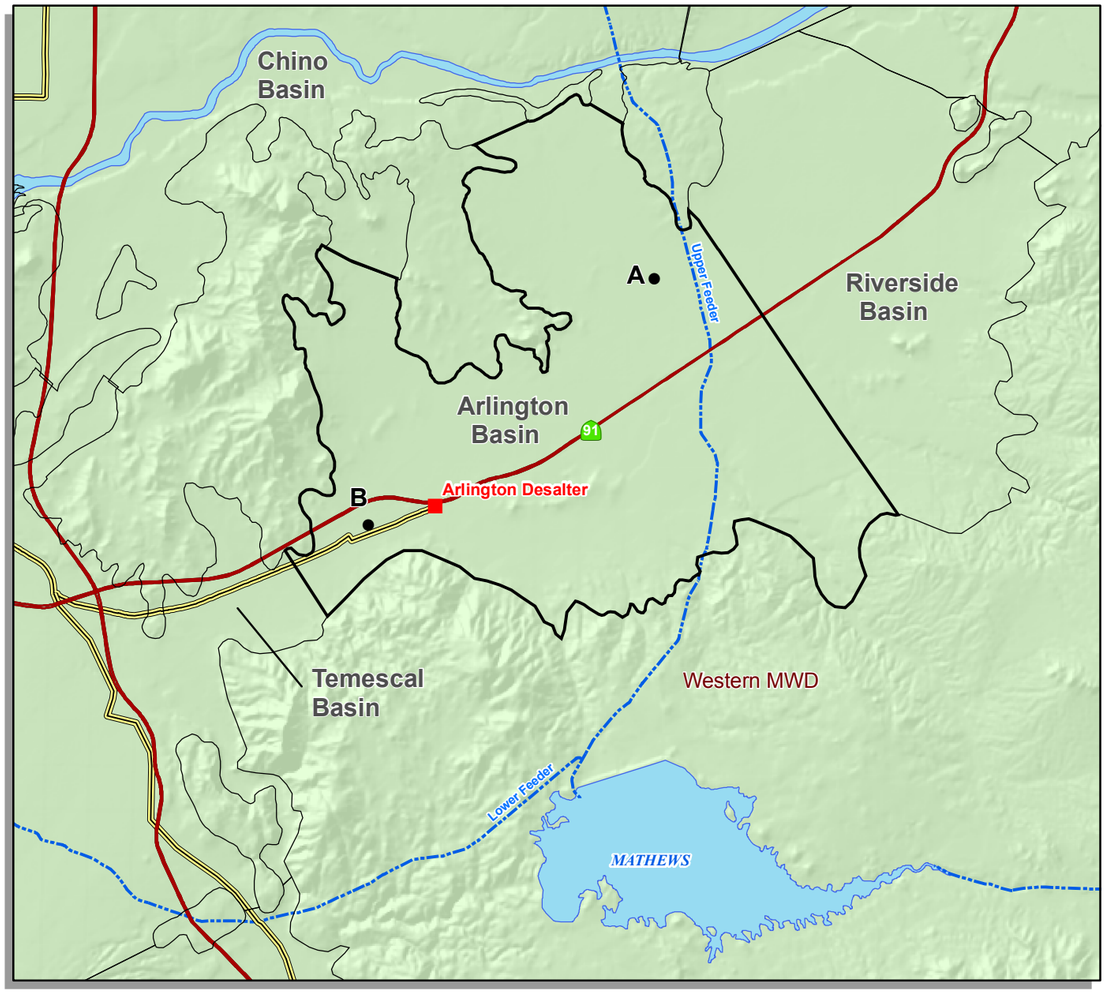


## Arlington Basin

A ● Key well
Desalter
Freeways
Water Bodies
MWD Pipeline
Santa Ana Regional Interceptor Line
Adjacent Basin
Basin
MWD Member Agency Boundary (color varies)

N W E S

0.75 0.375 0 0.75 Miles

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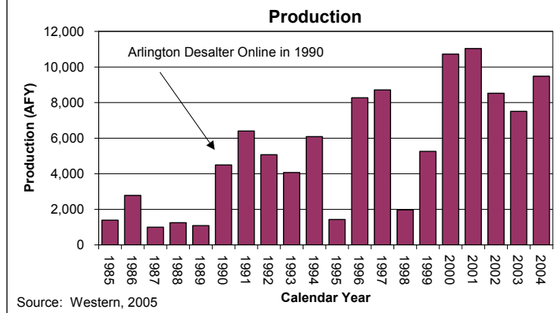
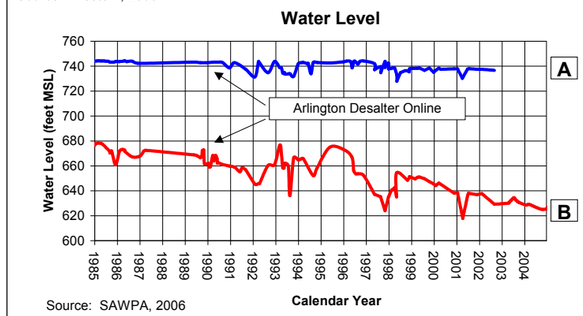
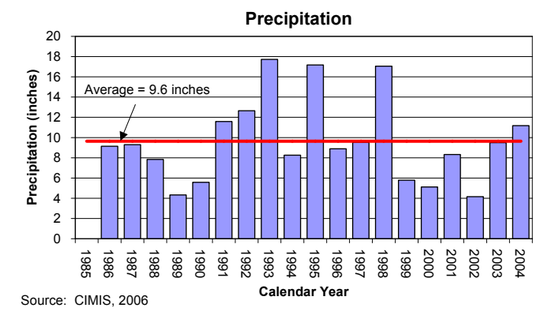
Additional Data Sourse(s): Santa Ana Watershed Project Authority (SAWPA); California Spatial Information Library (CaSIL).




Source: Western, 2005




Source: SAWPA, 2006




Source: CIMIS, 2006

### Direct Groundwater Recharge

No direct groundwater recharge data available for this basin.

### BASIN FACTS

**Arlington Basin**

**Description**
**Location:** Riverside County
**Watershed Surface Area:** 12.8 square miles
**Management:** Unadjudicated
**MWD Member Agencies:**
Western MWD

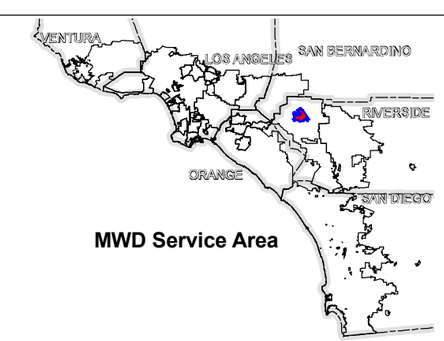
| | Arlington |
|---|---|
| **Natural Safe Yield** | Unknown |
| **Total Storage** | 101,000 AF |
| **Unused Storage Capacity** | 32,000 AF |
| **Portion of Unused Storage Capacity Available for Storage** | Unknown |

**Storage and Extraction Facilities**

| | Arlington |
|---|---|
| **Production Wells** | |
| Production Capacity | ~16,300 AFY |
| Average 1990-2004 | ~6,500 AFY |
| **Injection Wells** | |
| Injection Capacity | None |
| Average 1990-2004 | None |
| **Spreading Basins** | |
| Spreading Capacity | None |
| Average 1990-2004 | None |

**Basin Management Considerations**

- Water quality (TDS and nitrate) could limit potential for storage and extraction
- Concentrations of TCE, PCE, perchlorate and DBCP may also limit potential for future use
- Arlington Desalter has increased utilization of basin. Current desalting capacity is 6,400 AFY




**MWD Service Area**

**Plate 14-1**
**Overview of Arlington Basin**

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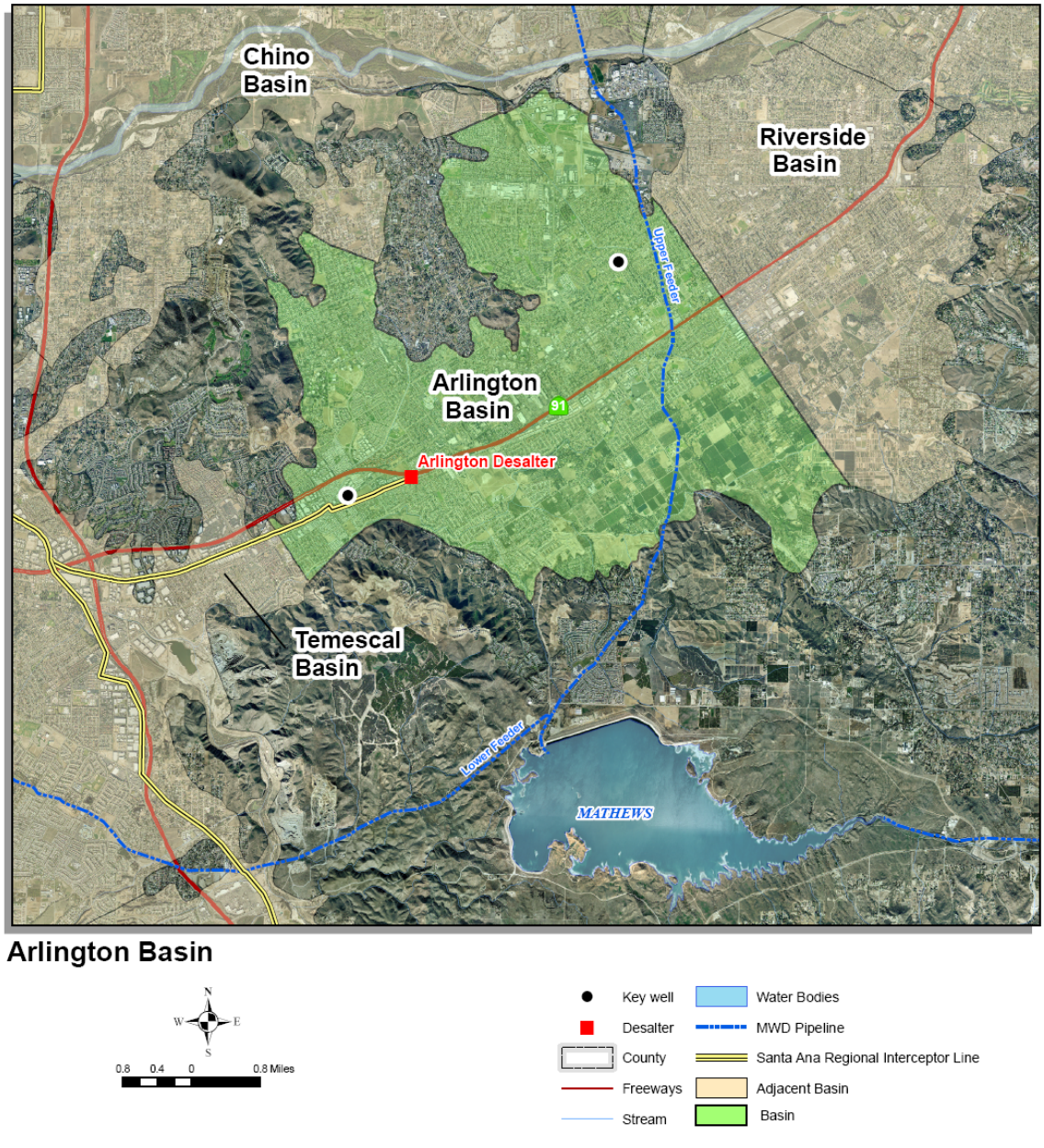
The Arlington Basin is an unadjudicated groundwater basin located south of the Santa Ana River in northwestern Riverside County. The Arlington Basin includes the communities of Riverside and portions of unincorporated Riverside County. The Arlington Basin underlies the service area of Western Municipal Water District of Riverside County (Western MWD). A map of the basin is provided in **Figure 14-1**.

**Figure 14-1**
**Map of the Arlington Basin**



## BASIN CHARACTERIZATION

The following section provides a physical description of the Arlington Basin including its geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

Groundwater occurrence in the Arlington Basin is generally unconfined. Groundwater producing zones in the Arlington Basin are characterized by considerable sand and little clay (DWR, 2004). Total storage in the basin is approximately 101,000 AF. Based upon Spring 2005 water levels there is about 69,000 AF in storage. Therefore, the unused storage space is approximately 32,000 AF. However, not all of the unsaturated portion can be used. The amount of unused storage space that could be used is unknown. Hydrogeologic data for the Arlington Basin are summarized in **Table 14-1**.

**Table 14-1**
**Summary of Hydrogeologic Parameters of Arlington Basin**

| Parameter | Description |
|---|---|
| **Structure** | |
| Aquifer(s) | Unconfined alluvium |
| Depth of groundwater basin | 0 to 300 feet |
| **Yield and Storage** | |
| Natural Safe Yield | 8,300 AFY |
| Total Storage | 101,000 AF |
| Unused Storage Space | 32,000 AF |
| Portion of Unused Storage Space Available for Storage | Unknown |

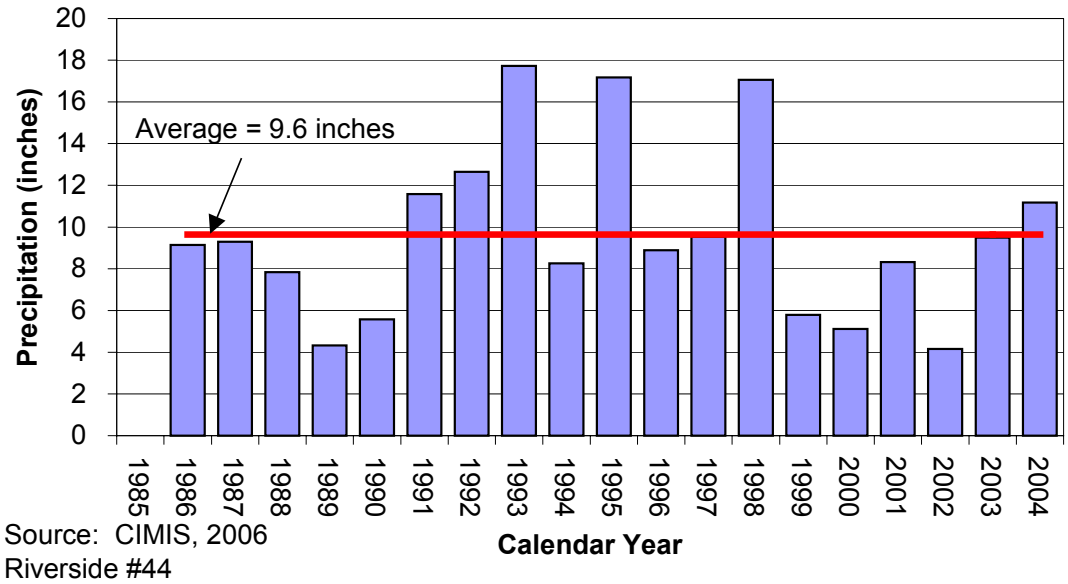
### Safe Yield/Long-Term Balance of Recharge and Discharge

The Arlington Basin is replenished by infiltration from unlined stream channel overlying the basin, underflow from saturated alluvium and fractures within the bordering bedrock hills, return flows and percolation of precipitation (DWR, 2004; Wildermuth 2000, Wildermuth, 2006). Safe yield has not been determined for the Arlington Basin alone. Based upon a water budget analysis prepared by the City of Riverside (Riverside, 2005) for the combined Arlington-Riverside Basins, the long-term production from the Arlington Basin that yielded a balanced water budget was approximately 8,300 AFY.

The Arlington Basin is relatively dry with average precipitation of 9.6 inches per year. **Figure 14-2** provides the historical precipitation data from the CIMIS Riverside #44 Station

located near UC Riverside (CIMIS 2006). These data suggest below average precipitation from 1986 to 1990 and from 1999 to 2003, above average precipitation between 1991 and 1998 and since 2004.

**Figure 14-2**
**Historical Precipitation near the Arlington Basin**




Source: CIMIS, 2006
Riverside #44

## GROUNDWATER MANAGEMENT

The following section describes how the Arlington Basin is currently managed.

### Basin Governance

The Arlington Basin is not adjudicated. Western MWD reports on the conditions of the Arlington Basin in addition to other groundwater basins in the Santa Ana River Watershed within its service area. Basin pumping activities are not formally regulated. The Arlington Basin is part of the Santa Ana River Watershed and falls under the jurisdiction of the Santa Ana Watershed Project Authority (SAWPA). **Table 14-2** provides a list of governing agencies in the Arlington Basin and their respective roles.

### Interactions with Adjoining Basins

A groundwater divide in the alluvium separates the Arlington Basin from the Riverside Basin to the north (DWR, 2004). In the southwest, groundwater exits the Arlington Basin into the Temescal Basin as underflow through a bedrock gap. These boundaries are not barriers to flow. There are no agreements that govern these flows.

## WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Arlington Basin.

**Table 14-2**
**Summary of Management Agencies in the Arlington Basin**

| Agency | Role |
|---|---|
| Western Municipal Water District | Reports on water extraction for Arlington Basin and operates Arlington Desalter. |
| Santa Ana Water Project Authority (SAWPA) | Joint Powers Authority established to plan and build facilities to protect the water quality of the Santa Ana River Watershed. |
| California Regional Water Quality Control Board – Santa Ana Region (Regional Board) | Issuance of permits for discharges within the Santa Ana River Watershed. |

### Active Production Wells

There are currently 12 active production wells in the Arlington Basin. **Table 14-3** summarizes data related to active production wells in the Arlington Basin since 1990 when the Arlington Desalter came online. Since 1990, nearly 95 percent of the production within the Arlington Basin feeds the Arlington Desalter discussed below. **Figure 14-3** summarizes the historical production data in the Arlington Basin. Basin production has increased from an average of about 1,500 AFY between 1985 and 1989 to nearly 9,500 AFY between 2000 and 2004. This increase is due to the operation of the Arlington Desalter.

**Table 14-3**
**Summary of Production Wells in the Arlington Basin**

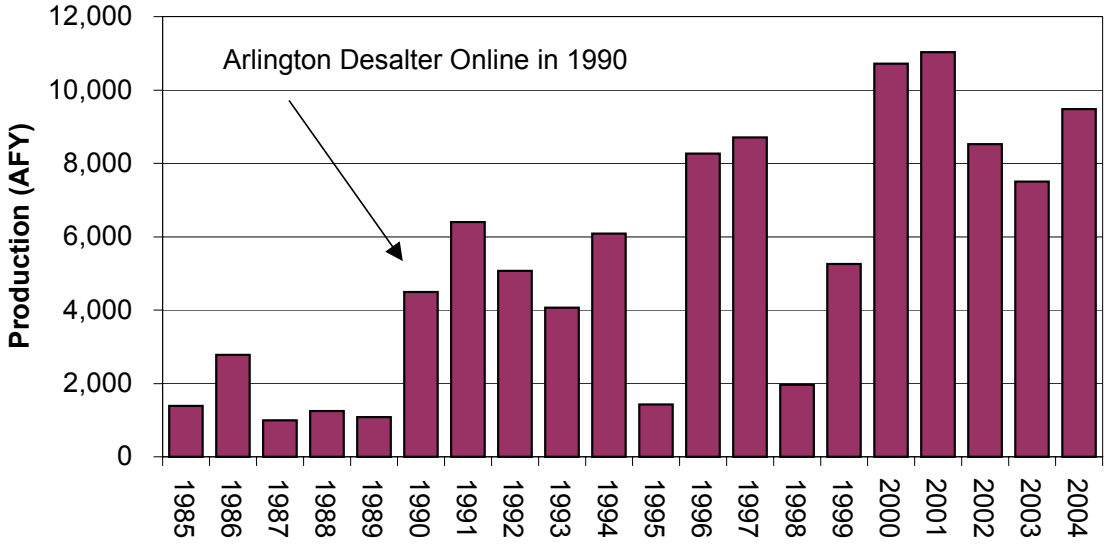
| Category | Number of Active Wells [1] | Estimated Production Capacity [2] (AFY) | Average Production 1990-2004 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| Desalter Wells | 5 | 9,220 | 5,214 | Not available |
| Other Wells | 7 | 7,071 | 1,325 | |
| Total | 12 | 16,291 | 6,539 | |

Source: Western MWD, 2005 and Wildermuth, 2006
1. Active wells have production within past 5 years
2. Estimated production capacity is based upon maximum annual production in past 5 years. Estimated capacity from other wells determined by Wildermuth, 2006.

**Other Production**

Prior to 1997, surface diversions from the Harrison Wash by the City of Riverside were a source of additional production with an average of about 250 AFY. This source has been inactive since 1997.

**Figure 14-3**
**Historical Groundwater Production in the Arlington Basin**




Source: Western MWD, 2005

**ASR Wells**

There are no ASR wells in the Arlington Basin.

**Spreading Basins**

There are no spreading basins in the Arlington Basin.

**Seawater Intrusion Barriers**

There are no seawater intrusion barriers in the Arlington Basin.

**Desalters**

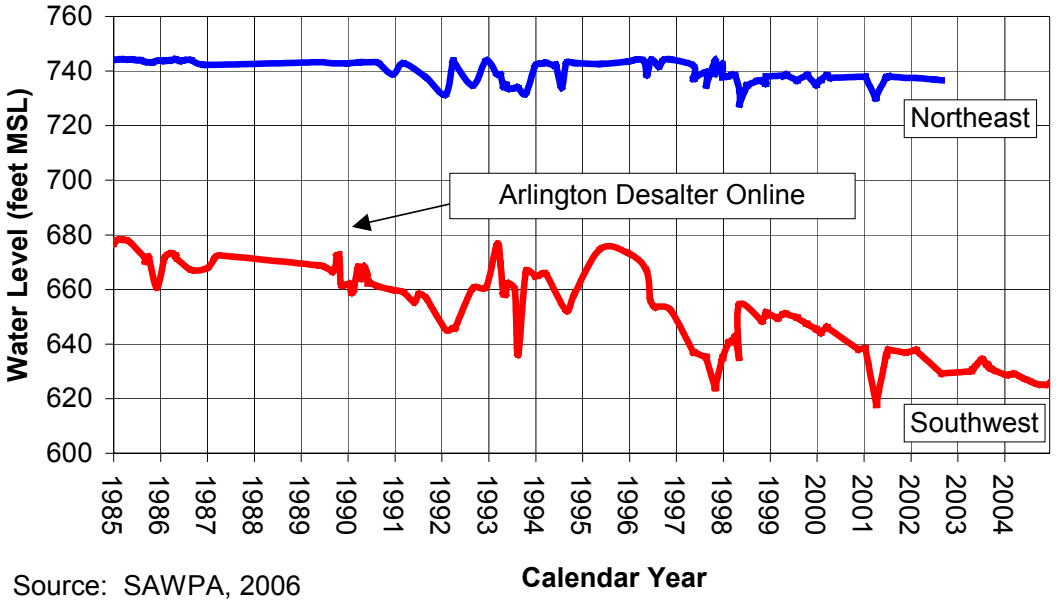
The existing Arlington Desalter facility, operating since 1990, extracts and treats impaired groundwater from the Arlington basin in the southwestern area of the City of Riverside. The desalter, using Reverse Osmosis (RO) technology, produces up to six (6) million gallons per day (MGD) of blended desalinized water, with another estimated one (1) MGD of concentrated brine (high salinity water) generated by the plant discharged to the Santa Ana Regional Interceptor

(SARI) line, which is treated by Orange County Sanitation District and used for recharge by Orange County Water District (SAWPA, 2006a). The desalter was managed and operated by SAWPA until 2005. At that time, the desalter assets and operations were transferred to Western MWD. Water from the Arlington Desalter is supplied to the City of Norco to meet municipal demand.

## GROUNDWATER LEVELS

Groundwater flow is generally toward the north and west in the northern portion of the basin and southwest toward the Temescal Basin in the southern portion (DWR, 2004). In general, water levels in the Arlington Basin are relatively shallow with depths to water ranging from 10 to 60 feet below ground surface. Water level data from select inactive production wells in the basin are shown in **Figure 14-4**. In the northeastern part of the basin, water levels were relatively stable between 1985 and 2004. Water levels have declined about 50 feet in the southwest portion of the Arlington Basin during this same period. This decline is likely due to this well's proximity to the Arlington Desalter.

**Figure 14-4**
**Historical Water Levels in the Arlington Basin**




Source: SAWPA, 2006

## GROUNDWATER QUALITY

The following provides a brief description of the current water quality of the Arlington Basin. It includes a discussion of current groundwater monitoring activities, contaminants of concern and treatment processes for the region.

**Groundwater Quality Monitoring**

Groundwater quality samples are collected from active production wells in accordance with California DHS requirements as specified in Title 22 of the California Code of Regulations.

The Santa Ana Watershed Basin Monitoring Task Force is a collaborative effort of public and private sector agencies and interests. As part of this effort, SAWPA compiles water quality data in the Santa Ana River Watershed, including total dissolved solids (TDS) and nitrate (as N) data. SAWPA also prepares a triennial update of the ambient groundwater quality throughout all the groundwater basins in the Santa Ana River Watershed.

**Groundwater Contaminants**

Contaminants of concern for the Arlington Basin from active production wells are summarized in **Table 14-4**. Inorganic constituents of concern for the Arlington Basin are TDS and nitrate. The native groundwater is currently non-potable with historical ambient levels of TDS and nitrate (as N) of 983 mg/L and 25.5 mg/L, respectively (Wildermuth, 2005). Average TDS concentrations of the active production wells from which data were available ranged from 964 to 1,400 mg/L with an average of 1,118 mg/L between 1994 and 2004. Average nitrate concentrations (as nitrogen) ranged from 13.6 to 22.7 mg/L with an average of 18.3 mg/L during the same period. (SAWPA, 2006b)

Trichloroethylene (TCE) and tetrachloroethylene (PCE) have been detected in various wells in the Arlington Basin. Concentrations of TCE have ranged from non-detect (ND) to 29 µg/L. Concentrations of PCE have ranged from ND to 0.7 µg/L, which is below the MCL of 5 µg/L for PCE. These wells are currently treated by the Arlington Desalter.

In addition, perchlorate and dibromochloropropane (DBCP) have also been detected in produced groundwater from five wells in the Arlington Basin. Concentrations of perchlorate ranged from 2 µg/L to 7.3 µg/L with an average of 5.6 µg/L between 1994 and 2004 (SAWPA, 2006b). Some of these concentrations are above the notification level of 6 µg/L. DBCP has also been detected in produced groundwater from the Arlington Basin. Concentrations have ranged from non-detect to 0.07 µg/L between 1994 and 2004 (SAWPA, 2006b). The MCL for DBCP is 0.2 µg/L. These wells are currently treated by the Arlington Desalter.

**Blending Needs**

Because the water quality of the Arlington Basin does not currently meet drinking water standards for TDS and nitrate, water is treated by the Arlington Desalter and/or blended to meet municipal demand.

**Groundwater Treatment**

As discussed above, the Arlington Desalter treats up to 6 MGD (6,400 AFY) of groundwater from the Arlington Basin.

**Table 14-4**
**Summary of Constituents of Concern in the Arlington Basin**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL = 500 | mg/L | 964 to 1,400<br>Average: 1,118 | Historical ambient concentration of 983 mg/L. Wells are treated by Arlington Desalter. |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/L | 13.6 to 22.7<br>Average 18.3 | Historical ambient concentration of 25.5 mg/L. Wells are treated by Arlington Desalter. |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL:<br>TCE = 5<br>PCE = 5 | µg/L | ND to 29 for TCE<br>ND to 0.7 for PCE | One well has been impacted by TCE with maximum concentrations above MCL of 5 µg/L. Three wells have been impacted by PCE with concentrations below MCL. |
| **Perchlorate**<br>Notification Level =6 | µg/L | 2 to 7.3<br>Average: 5.6 | Five wells within the Arlington Basin are known to have been impacted by perchlorate. Four wells have had concentrations above the current action level of 6 µg/L. |
| **DBCP**<br>Primary MCL = 0.2 | µg/L | ND to 0.07 | Five wells within the Arlington Basin are known to have been impacted by DBCP. |

Source: Wildermuth, 2005, SAWPA, 2006 and Regional Board, 2006

## CURRENT GROUNDWATER STORAGE PROGRAMS

There are no current groundwater storage programs in the Arlington Basin.

## BASIN MANAGEMENT CONSIDERATIONS

The ambient water quality of the Arlington Basin is poor, particularly with respect to nitrate and TDS, which limit its potential for storage and extraction. However, the Arlington Desalter does increase the ability to use the basin in the future. The current treatment capacity of 6,400 AFY could limit the ability to participate in a large-scale conjunctive use program.

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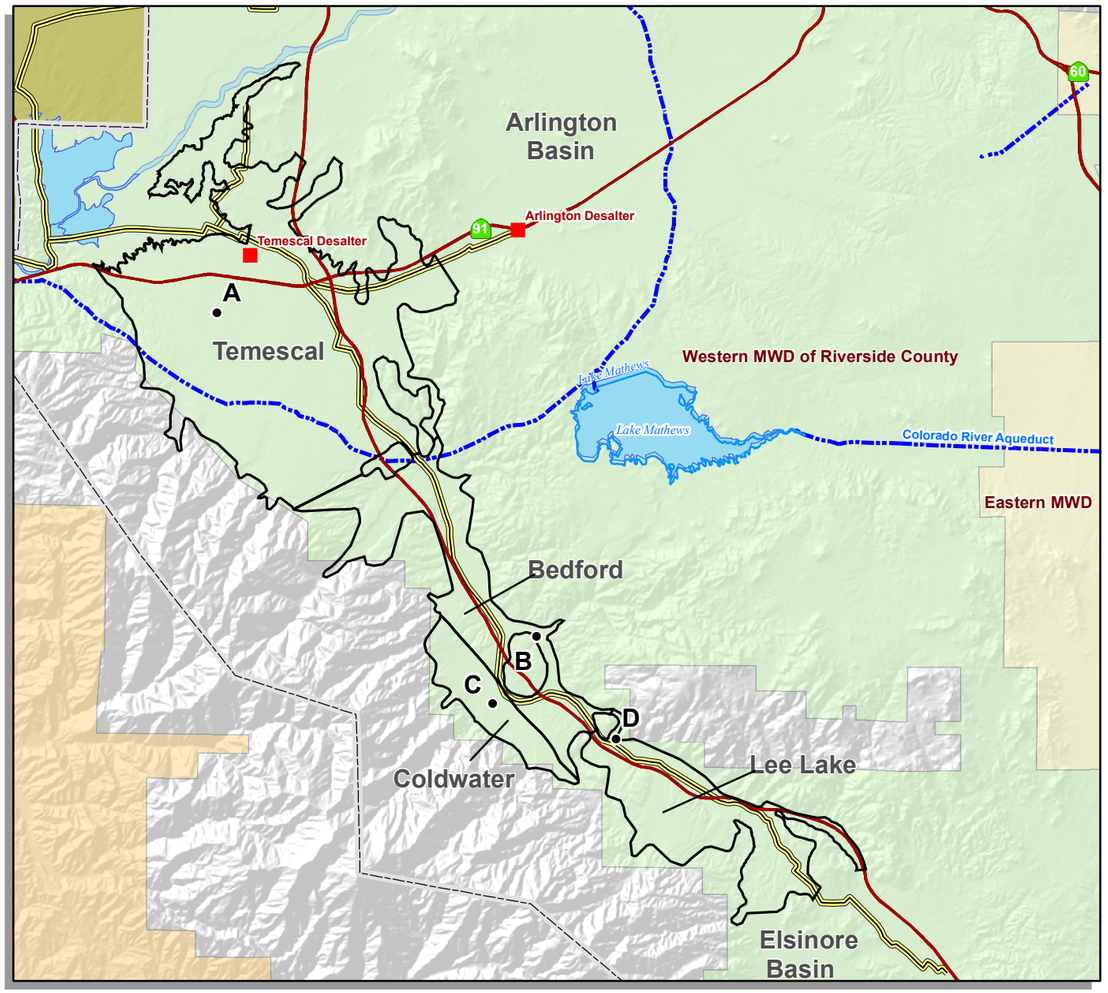


## Temescal Valley Basins

A • Key Well
Desalter
County
Freeways
River
Water Body
MWD Pipeline
Santa Ana Regional Interceptor Line
Basin
MWD Member Agency Boundary (color varies)

N W E S

3 1.5 0 3 Miles

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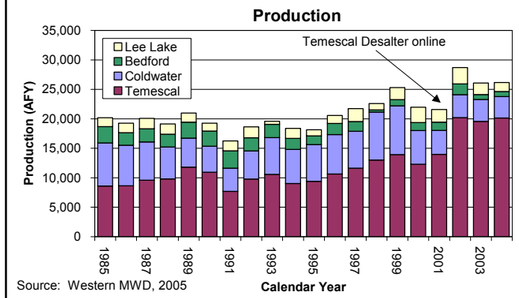
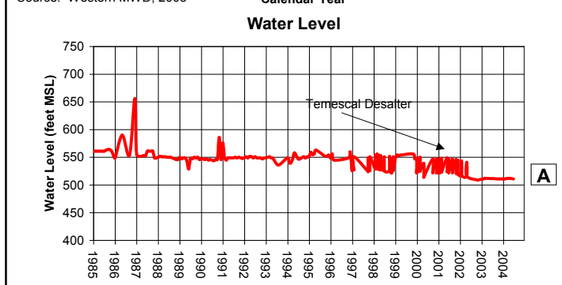
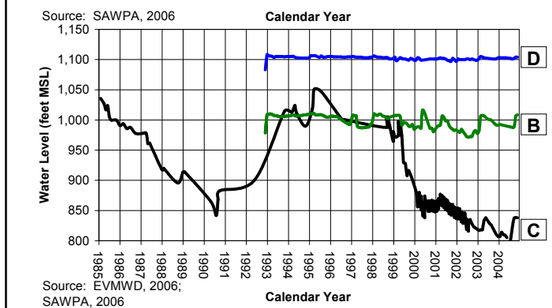


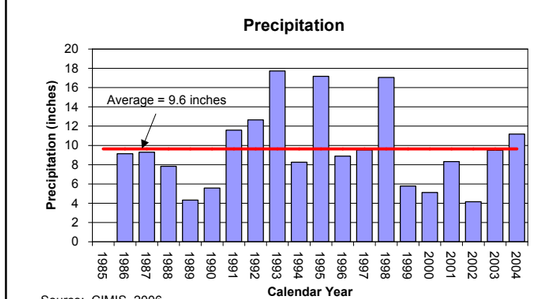

Source: Western MWD, 2005



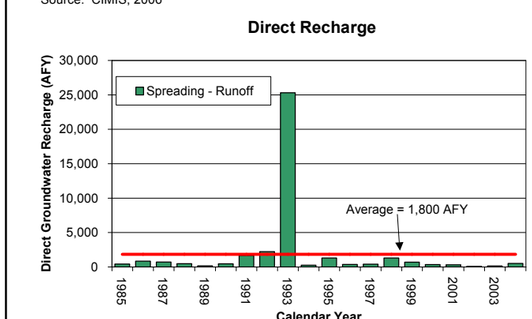

Source: SAWPA, 2006




Source: EVMWD, 2006; SAWPA, 2006




Source: CIMIS, 2006




## BASIN FACTS

### Temescal Valley Basins

**Description**
**Location:** Riverside County
**Watershed Surface Area:** 37 square miles
**Subbasins:**
Bedford
Coldwater
Lee Lake
Temescal
**Management:** Unadjudicated
The basins are not adjudicated. No formal groundwater management programs have been adopted for the Temescal Valley Basins.
**MWD Member Agencies:**
Western MWD

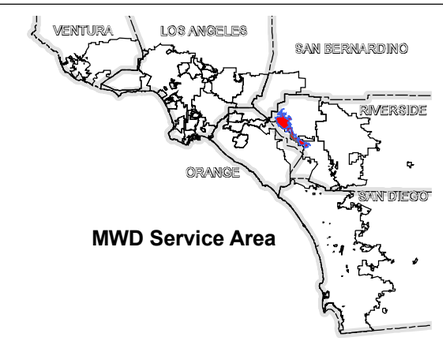
| | Bedford | Coldwater | Lee Lake | Temescal |
|---|---|---|---|---|
| **Natural Safe Yield** | Unknown | Unknown | Unknown | Unknown |
| **Total Storage** | Unknown | 100,000 AF | Unknown | Unknown |
| **Usable Storage Space** | Limited | Unknown | Limited | Unknown |
| **Portion of Unused Storage Space Available for Storage** | Limited | Unknown | Limited | Unknown |

**Storage and Extraction Facilities**

| | Bedford | Coldwater | Lee Lake | Temescal |
|---|---|---|---|---|
| **Production Wells** | | | | |
| Production Capacity | 2,000 AFY | 11,000 AFY | 3,000 AFY | 42,000 AFY |
| Average 1985-2004 | 1,833 AFY | 5,640 AFY | 1,694 AFY | 12,062 AFY |
| **Injection Wells** | | | | |
| Injection Capacity | None | None | None | None |
| Average 1985-2004 | None | None | None | None |
| **Spreading Basins** | | | | |
| Spreading Capacity | None | 12,000 AFY | None | None |
| Average 1985-2004 | None | 1,900 AFY | None | None |

**Basin Management Considerations**

- Higher concentrations of nitrate, iron, manganese and TDS limit use of the Temescal, Bedford and Lee Lake Basins
- Perchlorate concentrations up to 12 µg/L occur in wells from Temescal Basin
- Reliability on natural recharge to maintain water levels in smaller basins limits potential for use.
- Regional Board Basin objectives may limit recharge potential




**MWD Service Area**

## Plate 15-1
## Overview of Temescal Valley Basins

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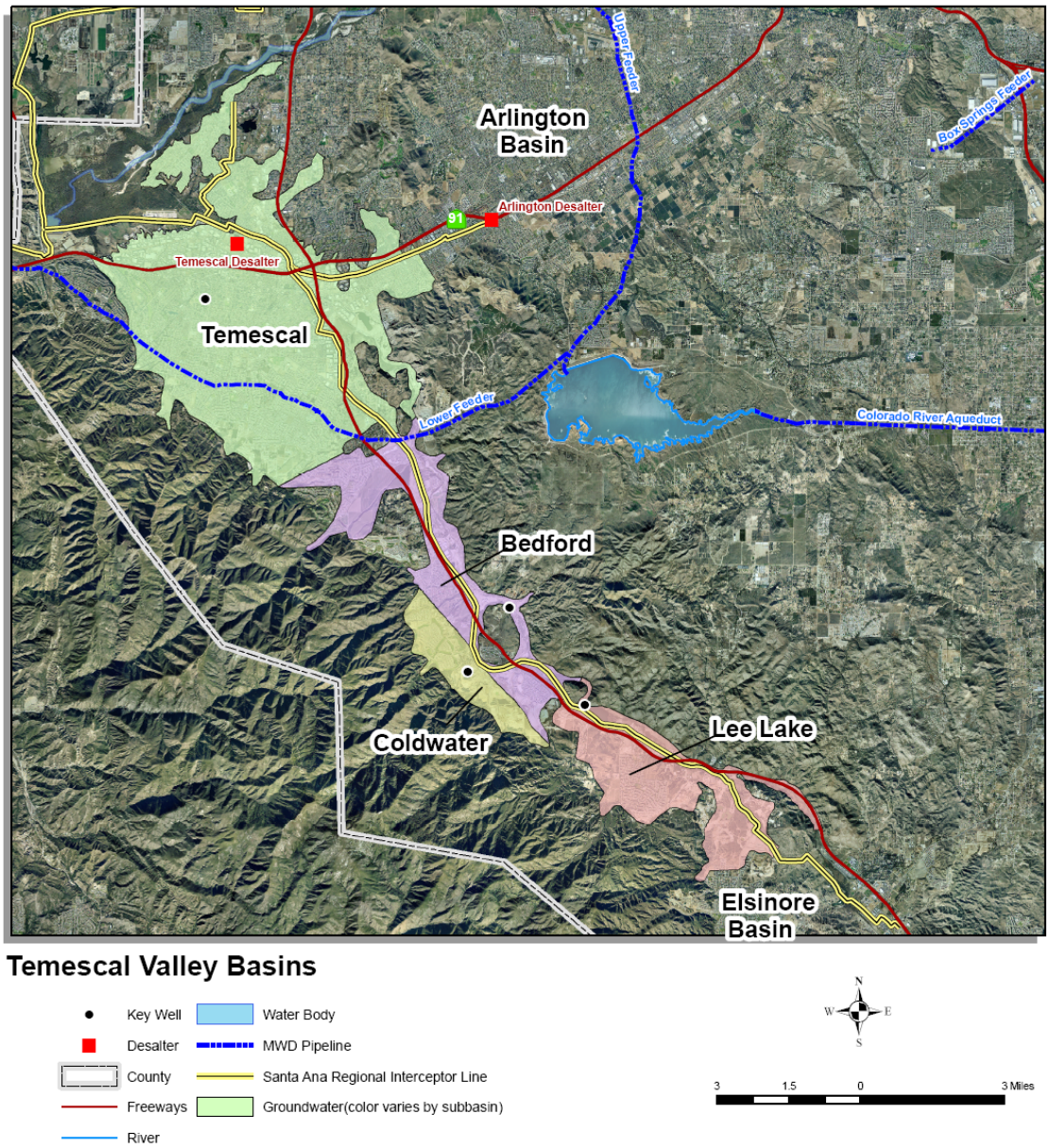
The Temescal Valley Basins include several small-unadjudicated groundwater basins in Riverside County between Prado Dam and Lake Elsinore along the Interstate 15 corridor. These include: the Bedford, Coldwater, Lee Lake, and Temescal basins. Because they are relatively small, these basins are discussed as a whole. The Temescal Valley Basins underlie the service area of Western Municipal Water District (Western MWD) and include the communities of Corona, Norco and unincorporated areas of Riverside County.

**Figure 15-1**
**Map of the Temescal Valley Basins**



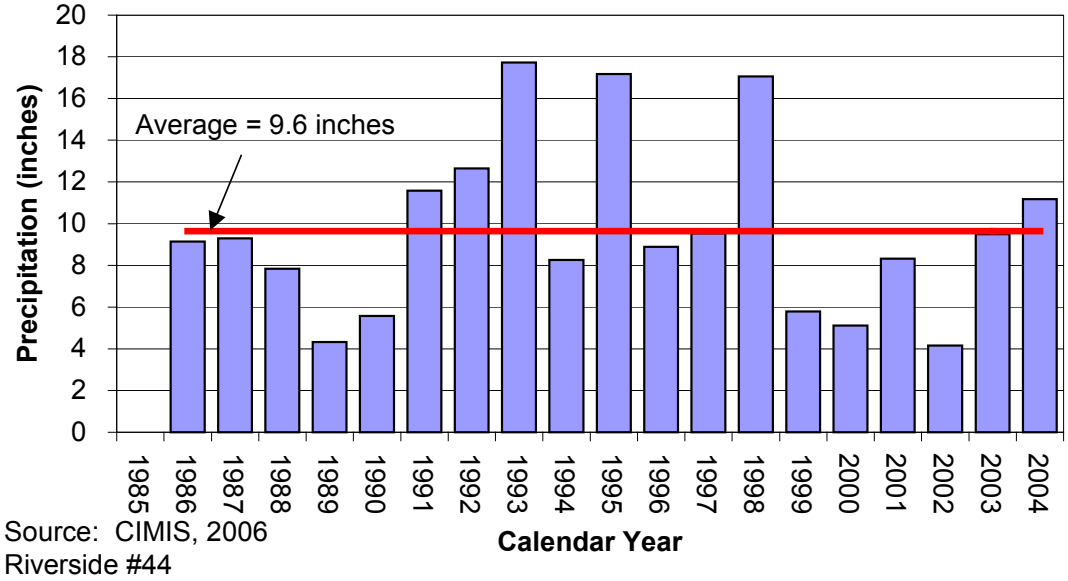
## BASIN CHARACTERIZATION

The following section provides a physical description of the Temescal Valley Basins including their geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

The following section describes the basin structure and storage capacity for each of the Temescal Valley Basins. Each basin is generally unconfined (one continuous aquifer) and therefore each responds rapidly to changes in hydrology and recharge. **Table 15-1** summarizes the hydrogeologic parameters for each basin. As shown in **Figure 15-2**, precipitation in the vicinity of the Temescal Valley Basins near Riverside averages approximately 9.6 inches per year.

**Figure 15-2**
**Historical Precipitation in the Temescal Valley Basins**




Source: CIMIS, 2006
Riverside #44

### Bedford Basin

The Bedford Basin is located south of the Temescal Basin in Temescal Canyon between the Santa Ana Mountains and the El Sobrante Hills. The basin covers an area of approximately 10 square miles with an alluvial depth ranging from 30 to 200 feet. (AKM, 2005). Groundwater within the basin tends to flow northwest into the Temescal Basin. Total storage within the basin is unknown.

### Coldwater Basin

The Coldwater Basin is located southwest of the Bedford Basin and the Temescal Wash. The Basin encompasses an area of approximately 2.6 square miles and lies within the structural block between the Santa Ana Mountains to the west and the El Sobrante Hills to the east. The Coldwater Basin is bound by the North Glen Ivy Fault to the northeast. The North Glen Ivy Fault behaves as an effective barrier to groundwater flow and prevents migration of groundwater from the Coldwater Basin into the Temescal Wash and the Bedford Basin at depth. Groundwater levels throughout the basin typically respond rapidly to precipitation and recharge because of the high permeability and limited groundwater storage within this basin. Maximum depth of the basin is approximately 600 feet. Total estimated storage in the Coldwater Basin is approximately 100,000 AF (MWH, 2004).

**Table 15-1**
**Summary of Hydrogeologic Parameters of Temescal Valley Basins**

| Parameter | Description |
|---|---|
| **Structure** | |
| Aquifer(s) | Unconfined to semi-confined alluvium |
| Depth of groundwater basin | Bedford: 30 to 200 feet<br>Coldwater: Up to 600 feet<br>Lee Lake: Less than 200 feet<br>Temescal: 180 to 480 feet |
| Thickness of water-bearing units | |
| **Yield and Storage** | |
| Natural Safe Yield | Data not available |
| Total Storage | Approximately 100,000 AF in Coldwater Basin |
| Unused Storage Space | Unknown |
| Portion of Unused Storage Space Available for Storage | Unknown |

### Lee Lake Basin

The Lee Lake Basin covers an area of approximately 12 square miles and has alluvial depth of less than 200 feet. Groundwater within the basin flows toward the northwest along the course of the Temescal Wash. Primary sources of recharge include the adjacent canyon streams and seepage from Temescal Wash. Total storage within the basin is unknown.

### Temescal Basin

The Temescal Basin encompasses an area of approximately 26 square miles bound by the Santa Ana River, La Sierra Hills, El Sobrante Hills and the Santa Ana Mountains. Typical depths for the City of Corona's wells in the Temescal Basin range from 180 to 480 feet (AKM, 2005). Groundwater flow is from the mountains to the center of the basin and northeast toward the Santa Ana River (DWR, 2006). Total storage within the basin is unknown.

### Safe Yield/Long-Term Balance of Recharge and Discharge

Safe yield has not been determined for any of the Temescal Valley Basins.

## GROUNDWATER MANAGEMENT

The following section describes how the Temescal Valley Basins are currently managed.

### Basin Governance

The Temescal Valley Basins are not adjudicated. The management agencies for the Temescal Valley Basins are described in **Table 15-2**. The City of Corona is currently preparing a groundwater management plan for the Temescal Basin to be completed in 2007.

**Table 15-2**
**Summary of Management Agencies in the Temescal Valley Basins**

| Agency | Role |
|---|---|
| City of Corona | Operation of Temescal Desalter<br>Preparation of Groundwater Management Plan for Temescal Basin. |
| Western Municipal Water District (Western MWD) | Part of Watermaster Committee responsible for administration of 1969 Santa Ana River Judgment. |
| San Ana River Watermaster | Watermaster for 1969 Stipulated Judgment that defined water allocations in the Santa Ana River among lower Santa Ana River and upper Santa Ana River producers. |
| Santa Ana Water Project Authority (SAWPA) | Joint Powers Authority established to plan and build facilities to protect the water quality of the Santa Ana River Watershed. |

### Interactions with Adjoining Basins

The Temescal Valley Basins are upstream of Prado Dam. On April 17, 1969, the Orange County Superior Court entered a Stipulated Judgment in Case No. 117628 involving the Orange County Water District vs. City of City of Chino et al.

The Judgment, which became effective October 1, 1970, contained a declaration of rights of the entities in the lower Santa Ana River area (i.e. OCWD) versus those in the upper Santa Ana River area (i.e. San Bernardino Valley Municipal Water District, or SBVMWD, Chino Basin MWD, now called IEUA, and Western MWD). The Judgment is administered by the Santa Ana River Watermaster, a committee of five members (one each from SBVMWD, IEUA and Western MWD and two from OCWD). Under this Judgment, purveyors upstream of Prado Dam, have the right to use all surface and groundwater supplies originating above Prado Dam without interference from water purveyors downstream of Prado Dam, provided that the average adjusted base flow at Prado Dam is at least 42,000 AFY. Baseflows have ranged from approximately 38,000 AFY in 1970 to approximately 170,000 AFY in 2002. (Santa Ana River Watermaster, 2003). SBVMWD has an obligation to ensure an average annual adjusted base flow of 15,250 AFY at Riverside Narrows. IEUA and Western MWD have a joint obligation to ensure average annual adjusted base flow of 42,000 AFY at Prado Dam. In addition, SBVMWD, IEUA and Western MWD are prohibited from exporting water from the lower area to the upper area while OCWD is prohibited from exporting water or causing water to from the upper area to the lower area (Santa Ana River Watermaster, 2003).

Fault or bedrock barriers prevent significant groundwater flow from the Temescal Valley Basins. Except for the 1969 Judgment described above, there are no agreements with other basins.

## WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Temescal Valley Basins.

### Active Production Wells

There are 53 active production wells within the Temescal Valley Basins. Historical production from 1985 to 2004 is summarized in **Figure 15-3**. A summary of the average production from these wells is provided in **Table 15-3**. Production by basin is discussed below.

#### Bedford Basin

There are 5 identified active wells in the Bedford Basin. The primary producer in the Bedford Basin is Elsinore Valley Municipal Water District (EVMWD). Groundwater production from the Bedford Basin has decreased in recent years from a high of approximately 2,900 AFY in 1991 to less than 900 AFY in 2004. The City of Corona has plans to drill news wells in this basin for future use (AKM, 2005).

#### Coldwater Basin

There are 9 identified wells in the Coldwater Basin. Primary producers in the Coldwater Basin include: the City of Corona and EVMWD. Historically, the Coldwater Basin production has been used for exportation outside the basin by both the City of Corona and EVMWD. EVMWD has stopped the exportation of Coldwater Basin water since 2004 because of low water levels in its wells. EVMWD has used three wells to serve municipal demand overlying the Coldwater

Basin. The primary source of domestic supply in the Coldwater Basin is groundwater from the EVMWD wells. Because of low water levels in 2004, this supply was supplemented by imported water from Lee Lake Water District.

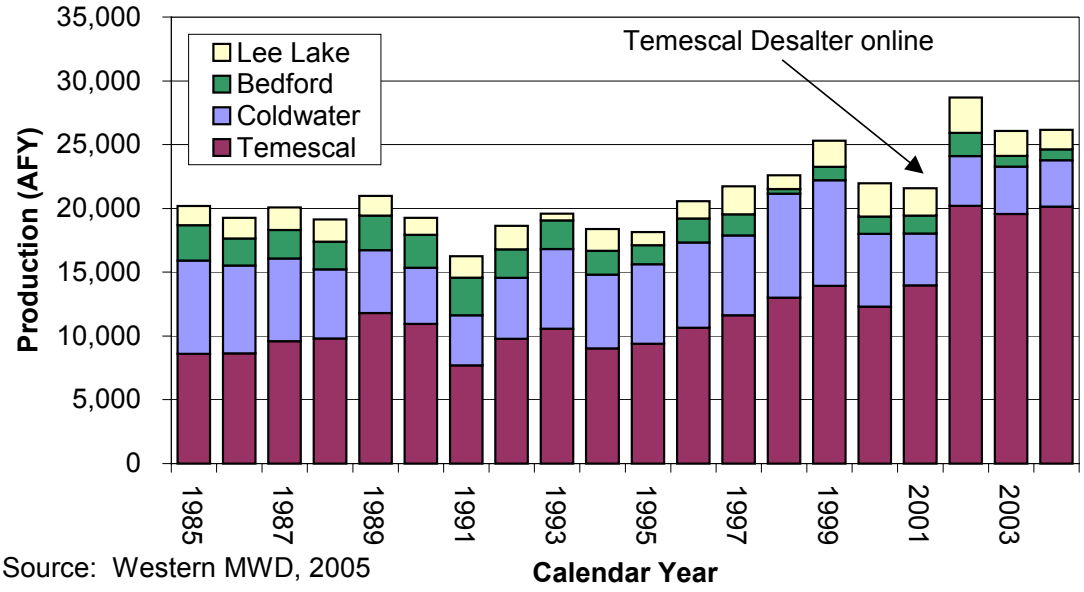
**Lee Lake Basin**

There are 10 identified active wells in the Lee Lake Basin. The primary producer of the Lee Lake Basin is EVMWD. This water is generally used for agricultural demand.

**Temescal Basin**

The City of Corona and the City of Norco are the primary pumpers from the Temescal Basin. Currently, 18 City of Corona wells with a combined annual capacity of approximately 39,000 AF extract groundwater from the Temescal Basin. In the past five years, Corona has drilled and equipped seven new wells to supply water to the Temescal Basin Desalter, which came online in 2001. The City of Corona plans to pump 29,765 AFY by year 2015 and will continue to pump that amount (AKM, 2005). The City of Norco has four wells in the Temescal Basin. The remaining wells are owned by private producers. In 1985, about 50 percent of the total production in the Temescal Basin was by the combined cities of Corona and Norco. Since the Temescal Desalter came online, more than 95 percent of the total production has come from these cities.

**Figure 15-3**
**Historical Groundwater Production in the Temescal Valley Basins**




Source: Western MWD, 2005

**Table 15-3**
**Summary of Production Wells in the Temescal Basin**

| Basin | Number of Active Wells [1] | Estimated Production Capacity [2] (AFY) | Average Production 1985-2004 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| Bedford | 5 | 2,000 | 1,833 | Not available |
| Coldwater | 9 | 11,000 | 5,640 | |
| Lee Lake | 10 | 3,000 | 1,694 | |
| Temescal | 29 | 42,000 | 12,062 | |
| **Total** | **53** | **58,000** | **21,229** | |

Source: Western MWD, 2005
1. Active wells have production within past 5 years
2. Estimated production capacity is based upon maximum annual production in past 5 years or published data where available

**Other Production**

Major stream flows in the Coldwater and Lee Lake basins are diverted and either spread, used for irrigation or stored in Lee Lake. Between 1985 and 2004, total diversions for Coldwater and Lee Lake basins have averaged approximately 1,800 AFY and 1,500 AFY, respectively.

**ASR Wells**

There are no ASR wells in the Temescal Valley Basins.

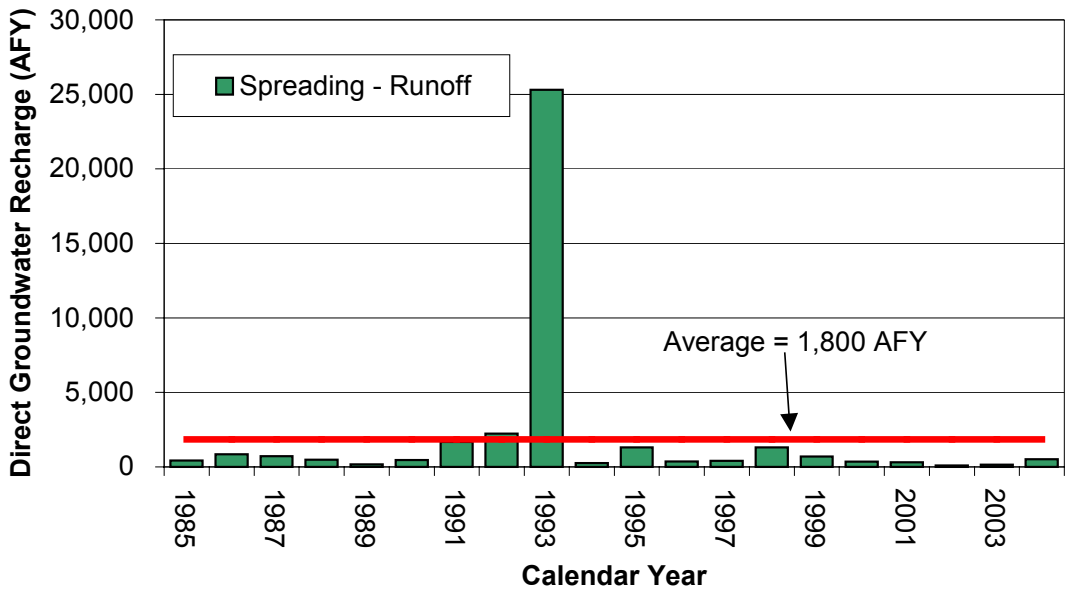
**Spreading Basins**

The only spreading basins in the Temescal Valley Basins are located in the Coldwater Basin. The City of Corona acquired the rights to the surface flows of Coldwater Canyon in 1964 when it purchased the assets of the Corona City Water Company. To meet California Department of Health Services requirements, the surface flow is spread in percolation ponds and extracted by the Corona's three Glen Ivy area wells in the Coldwater Basin. Historical groundwater recharge is shown in **Figure 15-4**.

There is a total spreading capacity of approximately 15 cfs. In addition, EVMWD has rights up to 1,000 AFY to divert flows from Mayhew Canyon and has spread the water in the adjacent gravel pits when not actively mined. Mining operations have limited the amount of water that can be spread in recent years. Recently, CEMEX, a gravel mining company, has constructed a concrete spillway at the north end of the basin to direct the Mayhew Canyon flow into the gravel

pit immediately downstream for stormwater runoff control. More recharge is anticipated in the future as a result of this modification. (EVMWD, 2006).

**Figure 15-4**
**Summary of Groundwater Recharge in Temescal Valley Basins**




### Seawater Intrusion Barriers

There are no seawater intrusion barriers in the Temescal Valley Basins.

### Desalters

The Temescal Desalter, located in the Temescal Basin, was completed in 2001. This facility utilizes approximately 6 miles of pipelines, 5 new wells, a blending station and 945 reverse osmosis membranes and has a capacity of approximately 10 million gallons per day (MGD), or about 11,000 AFY.

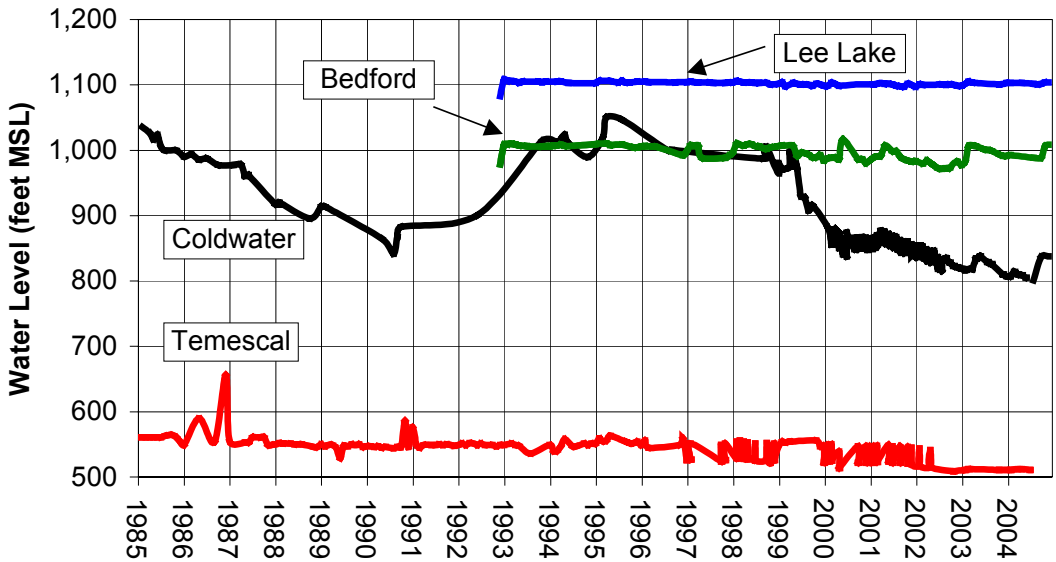
## GROUNDWATER LEVELS

The following section provides a brief discussion of water level trends in the Temescal Valley. Historical groundwater levels are shown in **Figure 15-5**.

### Bedford Basin

Limited water level data are available for the Bedford Basin. Depths to static groundwater are relatively shallow, ranging from less than 10 feet to about 30 feet. Therefore, there is limited storage space within this basin.

**Figure 15-5**
**Historical Groundwater Levels in the Temescal Valley Basins**




Source: SAWPA, 2006;; EVMWD, 2006 **Calendar Year**

### Coldwater Basin

In mid-2004, water levels in the Coldwater Basin were at a 20-year low due to lower than normal rainfall between 1999 and 2003 and decreased spreading of runoff. Groundwater levels in the Coldwater Basin track parallel with production (i.e. production is highest when water levels are highest and pumping costs are low). Production by the City of Corona wells in the Coldwater Basin has also decreased as production has increased in the Temescal Basin. Following the heavy rains of 2004/05, water levels in the Coldwater Basin had recovered nearly 40 feet by the end of 2004 and a total of 150 feet by June 2005.

### Lee Lake Basin

Like the Bedford Basin, limited water level data are available. Depths to static groundwater are relatively shallow, ranging from less than 10 feet to about 30 feet. Therefore, there is limited storage space within this basin.

### Temescal Basin

Groundwater levels in the Temescal Basin remained relatively stable between 1985 and 2000. Since the Temescal Desalter came online in 2001, groundwater levels have dropped as much as 40 feet. Depth to water is about 130 to 200 feet.

## GROUNDWATER QUALITY

The following section describes the overall water quality considerations for the Temescal Valley Basins. The water quality of the Coldwater Basin is generally good with TDS concentrations less than about 400 mg/L while the Bedford, Lee Lake and Temescal Basins are generally poorer quality with TDS concentrations above 700 mg/L.

### Groundwater Quality Monitoring

Groundwater quality samples are collected from active production wells in accordance with California DHS requirements as specified in Title 22 of the California Code of Regulations.

The Santa Ana Watershed Basin Monitoring Task Force is a collaborative effort of public and private sector agencies and interests. As part of this effort, SAWPA compiles water quality data in the Santa Ana River Watershed, including total dissolved solids (TDS) and nitrate (as N) data. SAWPA also prepares a triennial update of the ambient groundwater quality throughout all the groundwater basins in the Santa Ana River Watershed.

### Groundwater Contaminants

Primary constituents of concern for the Temescal Valley Basins are total dissolved solids (TDS), nitrate, iron and manganese. In addition, the occurrence of key constituents of regional concern, volatile organic compounds (VOCs) and perchlorate, are described for reference. These constituents are summarized in **Table 15-4**.

The ambient 20-year (1984 to 2003) average TDS concentrations for the Temescal Valley Basins ranged from 400 mg/L in the Coldwater Basin to 740 mg/L in the Bedford Basin. These data are presented graphically in **Figure 15-6**. The ambient groundwater quality of the Bedford and Lee Lake Basins is generally poor and does not typically meet secondary drinking water standards for TDS. TDS concentrations within the Bedford Basin are generally greater than 600 mg/L and have historically been greater than 1,100 mg/L. The current ambient TDS concentration for the Bedford Basin is 740 mg/L (Wildermuth, 2005). As such, most of the wells are used for agricultural irrigation or are inactive. Ambient concentrations of TDS have increased about 20 mg/L in the Coldwater Basin and decreased by about 80 mg/L in the Temescal Basin compared to the 1978 to 1997 average. TDS concentrations from wells in the Lee Lake Basin have ranged from about 450 to 700 mg/L since 1985. Ambient TDS concentrations exceed secondary standards for TDS in the Bedford and Temescal Basins, which limit their potential use without treatment.

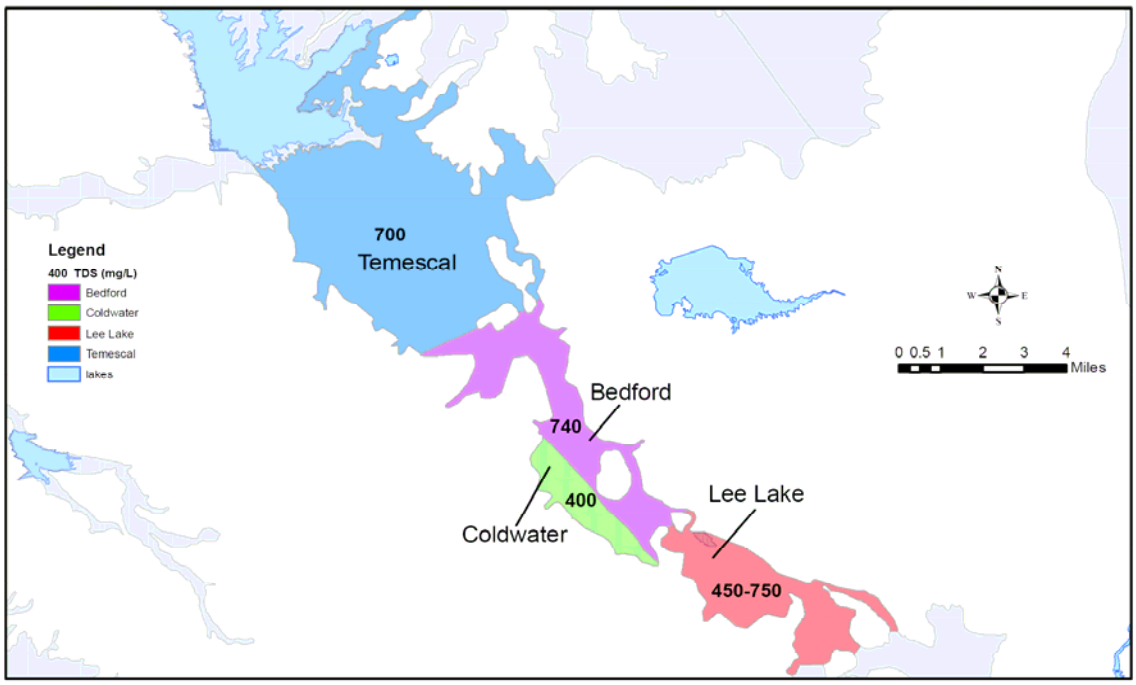
Ambient nitrate (as N) concentrations currently range from 2.4 mg/L in the Coldwater Basin to 12.8 mg/L in the Temescal Basin (Wildermuth, 2005). These data are presented graphically in **Figure 15-7**. Nitrate concentrations exceed the primary MCL of 10 mg/L in the Temescal Basin, potentially limiting its use without treatment. The ambient nitrate level in each basin dropped about 0.4 mg/L between 1997 and 2003. The current ambient nitrate concentrations in the Bedford Basin are about 2.8 mg/L as N (Wildermuth, 2005).

**Table 15-4**
**Summary of Constituents of Concern in Temescal Valley Basins**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL =500 | mg/L | Average: 400 to 740 | Average TDS concentrations in Coldwater and Temescal Basins are about 400 mg/L and 700 mg/L, respectively. TDS concentrations within the Bedford Basin are generally greater than 600 mg/L and have historically been greater than 1,100 mg/L. TDS concentrations from wells in the Lee Lake Basin have ranged from about 450 to 700 mg/L since 1985. |
| **Nitrate (as N)**<br>Primary MCL=10 | mg/L | Average: 2.4 to 12.8 | Lowest nitrate concentrations are found in the Coldwater Basin. Highest concentrations of nitrate are found in the Temescal Basin. Nitrate concentrations in the Bedford Basin have been as high as 5.8 mg/L since 1985. The current ambient nitrate concentrations are about 2.8 mg/L Nitrate concentrations in the Lee Lake Basin have been as high as 4.2 mg/L |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL<br>5 for TCE<br>5 for PCE | µg/L | ND to 4.4 for TCE<br>ND to 5 for PCE | Three known wells have had detections of TCE below the MCL in the Temescal Basin. One well has had detections of PCE in Temescal Basin. TCE and PCE were not detected in other basins. |
| **Perchlorate**<br>Notification level = 6 | µg/L | ND to 14 | 13 municipal production wells have had detection of perchlorate in the Temescal Basin. Perchlorate has not been detected in wells from the Bedford, Coldwater or Lee Lake Basins. |
| **Iron and manganese**<br>Secondary MCL:<br>300 for iron<br>50 for manganese | µg/L | ND to 3,000 for iron<br>ND to 3,000 for manganese | Four wells in Temescal Basin are currently treated for iron and manganese |

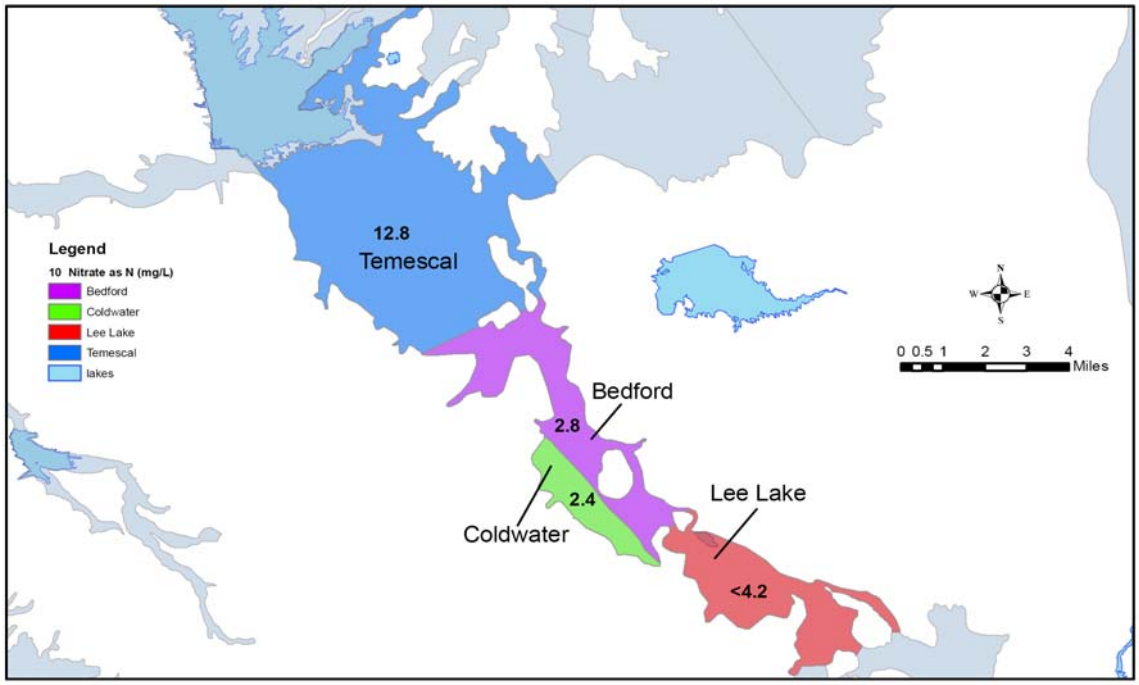
Source: Wildermuth, 2005, SAWPA, 2006 and Regional Board, 2006

**Figure 15-6**
**Ambient TDS Concentrations (1984 to 2003)**




Source: Wildermuth, 2005 and SAWPA, 2006

**Figure 15-7**
**Ambient Nitrate Concentrations (1984 to 2003)**




Source: Wildermuth, 2005 and SAWPA, 2006

Nitrate (as N) concentrations in the Bedford Basin have been as high as 5.8 mg/L since 1985 (SAWPA, 2006). Nitrate concentrations (as N) in the Lee Lake basin have been as high as 4.2 mg/L (SAWPA, 2006).

In addition to TDS and nitrate, elevated concentrations of perchlorate are encountered in the Temescal Basin. Thirteen municipal production wells in the Temescal Basin have known detections of perchlorate from 4 µg/L to 14 µg/L since 1998 (SAWPA, 2004; Regional Board, 2006). These wells are blended with other wells, imported water from Metropolitan or treated by the Temescal Desalter. Perchlorate has not been detected in wells from the Bedford, Coldwater or Lee Lake basins.

Three known wells have had detections of the VOC trichloroethylene (TCE) below the MCL in the Temescal Basin. One well has had detections of the VOC tetrachloroethylene (PCE) at or below the MCL in Temescal Basin. TCE and PCE were not detected in the other basins.

Iron and manganese are also detected above the applicable MCLs in the Temescal Basin. Concentrations range from non-detect to 3,000 µg/L.

**Blending Needs**

Nitrate concentrations in the Temescal Basin wells typically do not meet the EPA and DHS MCLs for nitrate (10 mg/L as N). The shallow basin groundwater typically has high levels of nitrate (0.9 to 24.4 mg/L as N) that has historically been blended to meet regulatory requirements. In 2001, the Temescal Desalter came online, eliminating the need for blending for nitrate.

In addition, perchlorate-impacted wells are blended with non-impacted sources to decrease the concentrations of perchlorate. Perchlorate-impacted water from three wells is treated by the Temescal Desalter (SAWPA, 2004).

**Groundwater Treatment**

The Temescal Desalter, completed in 2001, utilizes approximately 6 miles of pipelines, 5 new wells, a blending station and 945 reverse osmosis membranes. The cost to produce the water (pumping / filtering / delivering) for city residents is predicted to be $350 per AF. The capacity of the Temescal Desalter is approximately 16,803 AFY (AKM, 2005).

The City of Norco treats its wells for iron, manganese and hydrogen sulfide (City of Norco, 2005). Limited data are currently available related to this treatment.

## CURRENT GROUNDWATER STORAGE PROGRAMS

There are no current groundwater storage programs in the Temescal Valley Basins. However, the City of Corona and EVMWD are evaluating a groundwater storage program in the Coldwater Basin.

## BASIN MANAGEMENT CONSIDERATIONS

The following describes the basin considerations for each basin.

### Bedford and Lee Lake Basins

Because the Bedford and Lee Lake Basins are shallow, there is limited storage and extraction potential in either basin. In addition, water quality concerns, specifically TDS and nitrate, limit the usability of the Bedford and Lee Lake Basins for significant storage and extraction.

### Coldwater Basin

The usability of the Coldwater Basin is largely dependent upon natural recharge and gravel mining operations. When water levels are higher (less than about 200 feet below ground surface), fresher groundwater from the Coldwater Basin is lost to the open gravel pits and can spill into the Bedford Basin. Water levels are therefore maintained at a lower level. In addition, the TDS objective for the Coldwater Basin is 380 mg/L, which could potentially limit the ability to store water in this basin.

### Temescal Basin

Historically, the use of the Temescal Basin has been limited because of elevated concentrations of TDS and nitrate. Upon completion of the Temescal Desalter in 2001, the potential for storage and utilization of this basin has improved. Several wells in the basin are treated for iron and manganese, which could limit its potential.

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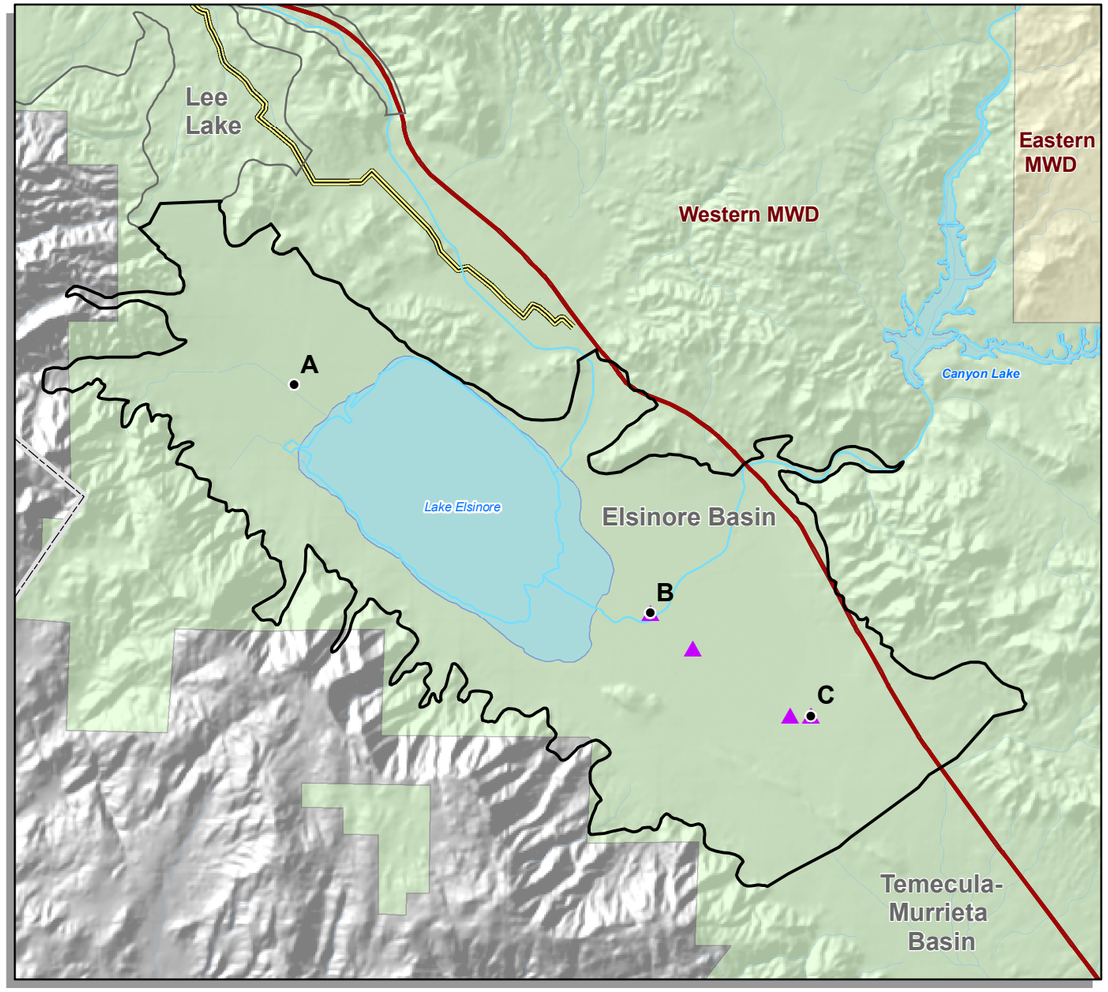


## Elsinore Basin

A Key Well
ASR Wells
County
Freeways
Stream
Water Body
MWD Pipeline
Santa Ana Regional Interceptor Line
Basin
Adjacent Basin
MWD Member Agency Boundary (colors vary)

N W E S

1 0.5 0 1 Miles

Note: This map was prepared by the Metropolitan Water District of Southern California for its own use. No warranty is expressed or implied as to the correctness, timeliness, or content of the information shown herein.

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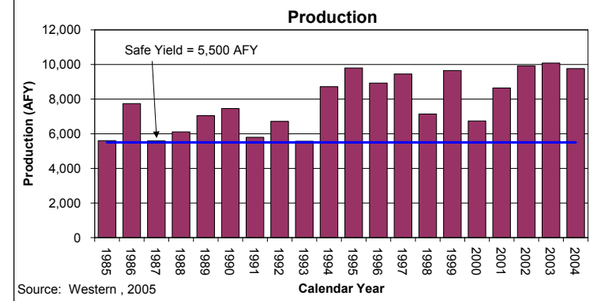
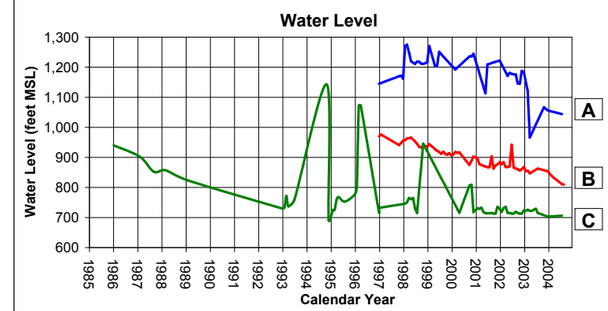
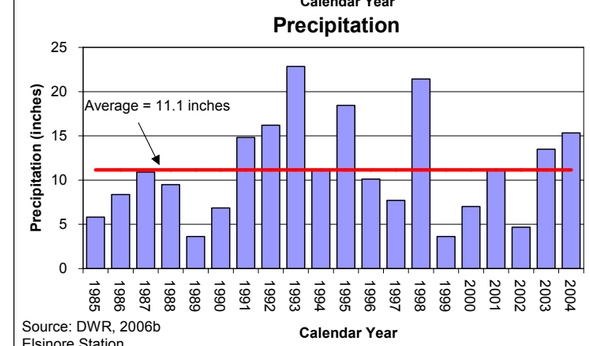
Additional Data Sourse(s): Santa Ana Watershed Project Authority (SAWPA); California Spatial Information Library (CaSIL).

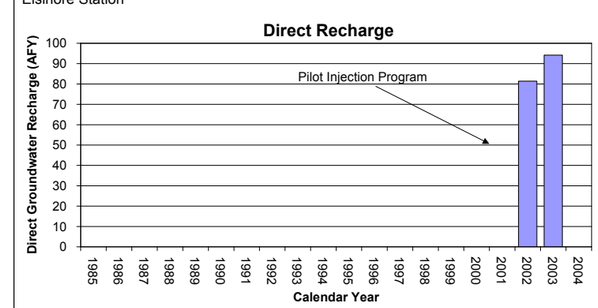



Source: Western , 2005




Source: DWR, 2006b
Elsinore Station




### BASIN FACTS

#### Elsinore Basin

**Description**
**Location:** Riverside County
**Watershed Surface Area:** 40.2 square miles
**Management:** Managed
EVMWD adopted a Groundwater Management Plan in 2004
**MWD Member Agencies:**
Western MWD
Eastern MWD

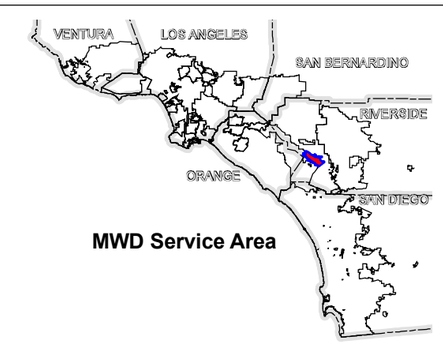
| | Elsinore |
|---|---|
| **Natural Safe Yield** | 5,500 AFY |
| **Total Storage** | 1.4 million AF |
| **Unused Storage Space (2001)** | 350,000 AF |
| **Portion of Unused Storage Space Available for Storage** | Unknown |

**Storage and Extraction Facilities**

| | Elsinore |
|---|---|
| **Production Wells** | |
| Production Capacity | ~15,000 AFY |
| Average 1985-2004 | ~7,800 AFY |
| **Injection Wells** | |
| Injection Capacity | 8,500 AFY |
| Average 2002-03 | 88 AFY |
| **Spreading Basins** | |
| Spreading Capacity | None |
| Average 1985-2004 | None |

**Basin Management Considerations**

- Lake augmentation obligation uses significant groundwater resources.
- Groundwater levels are declining and basin is in overdraft.
- Nitrate concentrations are increasing in some areas and affected areas could enlarge in some areas in the future.
- Potential for land subsidence.
- Water quality issues could limit storage potential.
- Water demands are projected to nearly double by 2020.




MWD Service Area

**Plate 16-1**
**Overview of Elsinore Basin**

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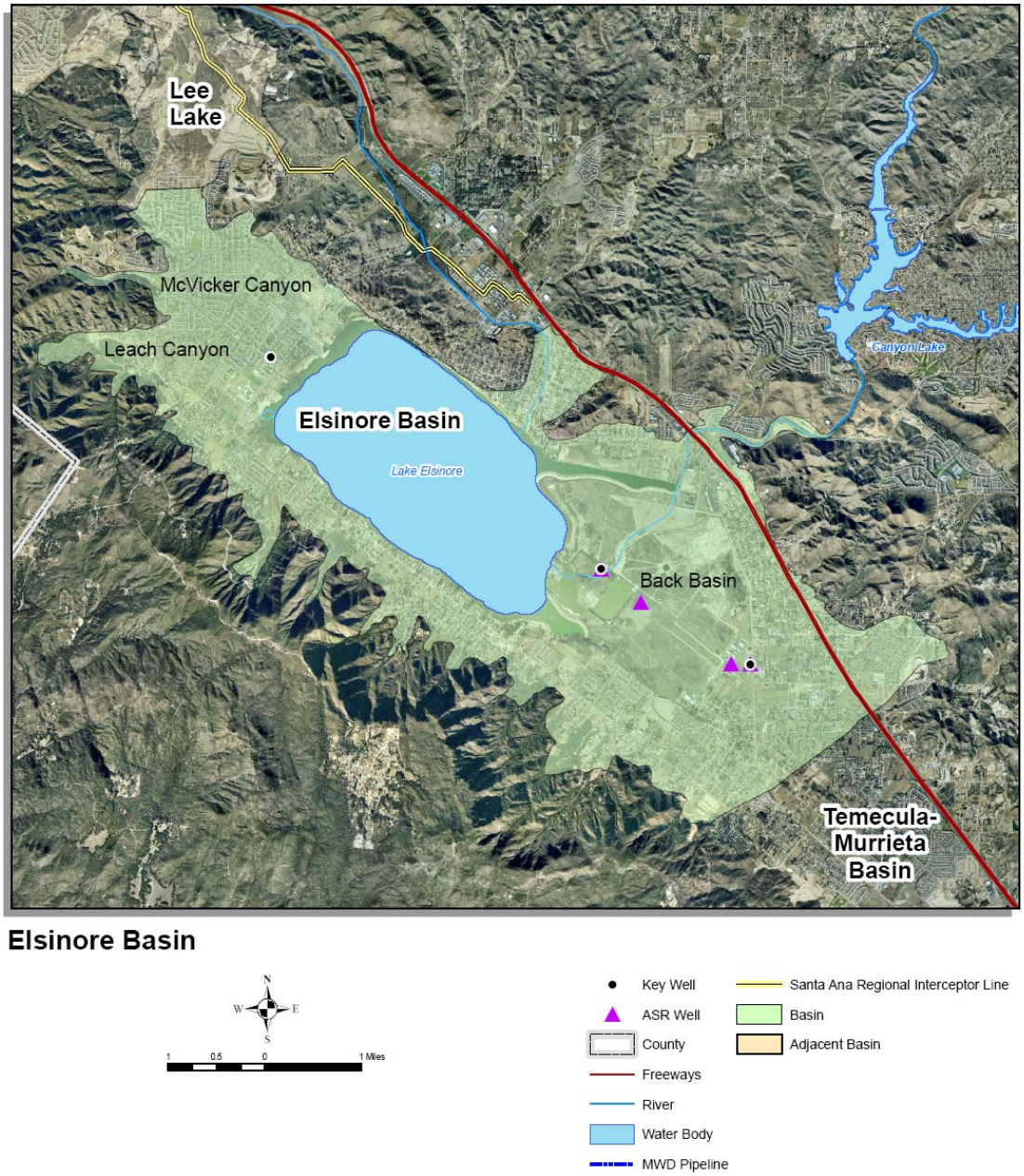
The Elsinore Basin underlies the Elsinore Valley in western Riverside County within the service area of Western Municipal Water District (Western MWD). The Elsinore Basin includes the communities of Lake Elsinore, Canyon Lake, Lakeland Village, Wildomar and portions of unincorporated Riverside County. A map of the basin is provided in **Figure 16-1**.

**Figure 16-1**
**Map of the Elsinore Basin**



## BASIN CHARACTERIZATION

The following section provides a physical description of the Elsinore Basin including its geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

The Elsinore Basin is bounded on the southwest by the Santa Ana and Elsinore Mountains along the Willard fault, a splay of the active Elsinore fault zone. The basin is bounded on the southeast by a shallow bedrock high coincident with a surface water divide that separates the Elsinore Basin from the Temecula-Murrieta Basin further to the southeast. The basin is bounded on the northwest by the Temescal Valley Basins at a constriction in the Temescal Wash, and on the northeast by non-water bearing rocks of the Peninsular Ranges along the Glen Ivy fault. Lake Elsinore lies in the closed basin formed between strands of the active Elsinore fault zone. (DWR, 2006A). The area referred to as the Back Basin includes the geographic area east of Lake Elsinore that represents the historical extent of the lake.

The Elsinore Basin is characterized by a series of down-dropped fault blocks between the Glen Ivy and Wildomar Fault Zones. As many as eight separate fault-bounded blocks are interpreted in the basin and there appears to be little groundwater movement between them (DWR 1981) thereby creating distinct pumping and storage zones within the basin.

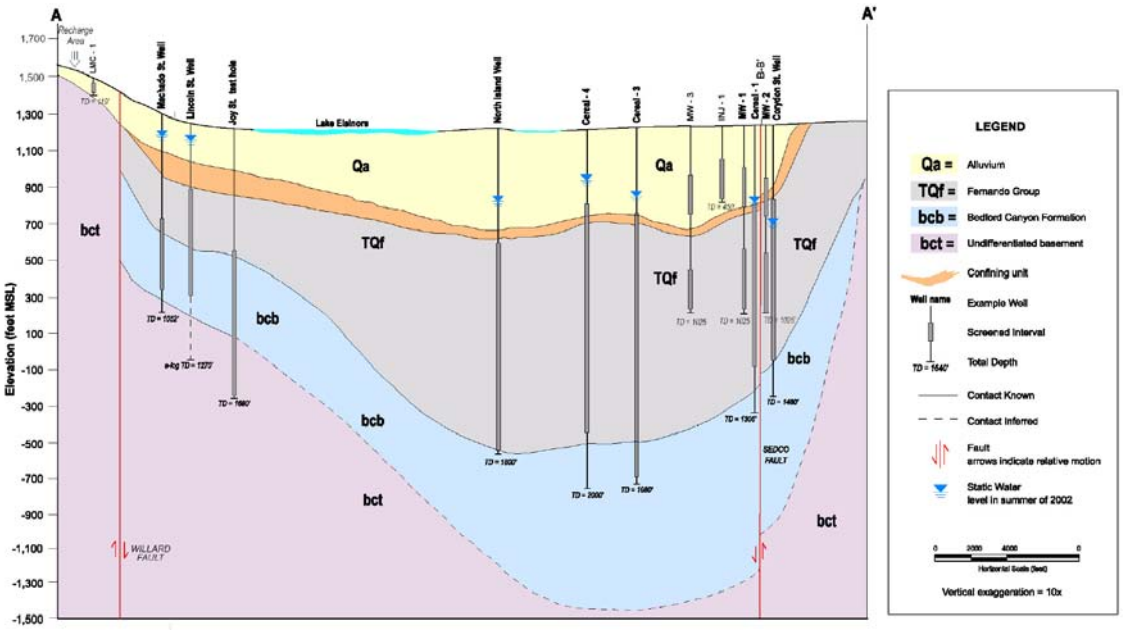
Groundwater occurs in two primary alluvial aquifers (the Upper aquifer, which is characterized by recent alluvium, and the Lower aquifer, which includes the Fernando Group and the Bedford Canyon Formation) separated by a semi-continuous confining clay. A conceptual cross section of the Elsinore Basin is provided in **Figure 16-2**. Perched groundwater as shallow as 25 feet below ground surface (bgs) can also be found in the Back Basin east of Lake Elsinore.

**Table 16-1** summarizes the hydrogeologic parameters for the Elsinore Basin. Total storage capacity is estimated to be about 1.4 million AF (EVMWD 2001). Approximately 1.155 million AF was estimated to be in storage in 2001 (EVMWD 2001). Approximately 350,000 AF of storage space is currently unused. It is unknown how much of the unused storage space is available for storage.

### Safe Yield/Long-Term Balance of Recharge and Discharge

The principal recharge of the basin is from infiltration of stream flow through alluvial fan deposits near the edges of the basin and through gravel deposits along the course of the San Jacinto River. Other contributing sources include infiltration from unlined channels overlying the basin, underflow from saturated alluvium and fractures within the surrounding bedrock mountains and hills (Wildermuth, 2000). Precipitation recharge is relatively minor. As shown in **Figure 16-3**, the average rainfall in the Elsinore Basin approximately 11.1 inches per year. Because of the predominance of clay beneath Lake Elsinore, it is assumed to be an insignificant source of recharge to the basin (MWH, 2003a).

**Figure 16-2**
**Conceptual Hydrogeologic Cross Section of the Elsinore Basin**

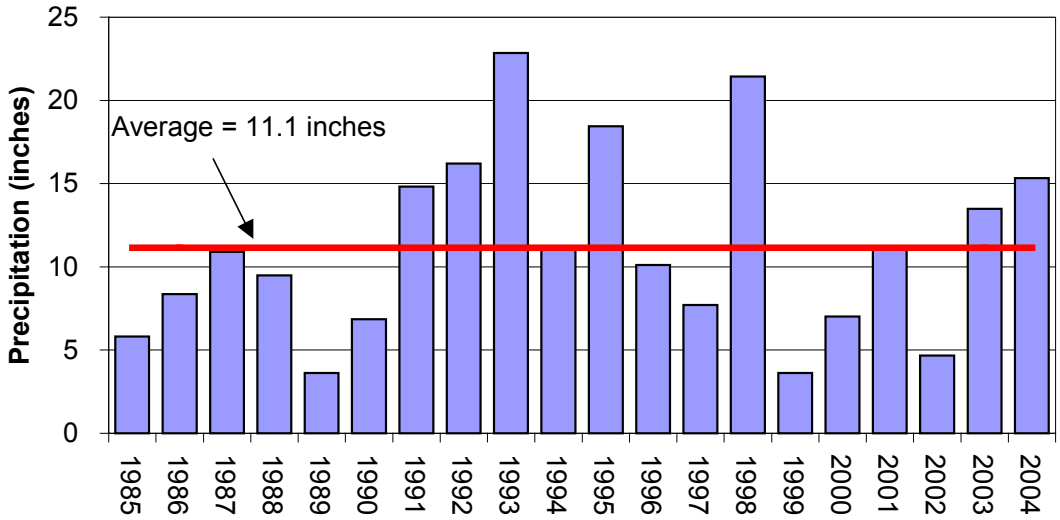



Source: MWH, 2004

**Table 16-1**
**Summary of Hydrogeologic Parameters of Elsinore Basin**

| Parameter | Description |
|---|---|
| **Structure** | |
| Aquifer(s) | Upper aquifer<br>Lower aquifer<br>• Fernando Group<br>• Bedford Canyon Formation |
| Depth of groundwater basin | 120 to 2,300 feet |
| Thickness of water-bearing units | Upper aquifer: 120 to 450 feet<br>Lower aquifer: ~800 to 2,000 feet |
| **Yield and Storage** | **Description** |
| Natural Safe Yield | 5,500 AFY |
| Total Storage | 1.4 million AF |
| Unused Storage Space | ~ 350,000 AF |
| Portion of Unused Storage Space Available for Storage | Unknown |

**Figure 16-3**
**Historical Precipitation in the Elsinore Basin**




Source: DWR, 2006b
Elsinore Station

The estimated natural safe yield of the Elsinore Basin is approximately 5,500 AFY (MWH, 2003a). Between 1990 and 2000, the annual groundwater deficit was approximately 1,800 AFY (MWH, 2003a).

## GROUNDWATER MANAGEMENT

The following section describes how the Elsinore Basin is currently managed. **Table 16-2** lists the governing agencies in the Elsinore Basin.

### Basin Governance

The Elsinore Basin is unadjudicated and is managed by the Elsinore Valley Municipal Water District (EVMWD), the primary producer from the basin. EVMWD adopted a groundwater management plan and groundwater monitoring plan in 2004 that conform to the requirements of Assembly Bill (AB) 3030 and Senate Bill (SB) 1938.

EVMWD is required by the City of Lake Elsinore to provide water to maintain water levels in Lake Elsinore. Currently, groundwater is used for lake augmentation. On average, about 3,200 AFY is needed to maintain lake levels in Lake Elsinore. As much as 12,500 AFY would be necessary during a dry year.

### Interactions with Adjoining Basins

The Elsinore Basin is essentially a closed basin as the basin is surrounded by shallow bedrock. When groundwater levels are above 1,100 feet MSL in the southeastern portion of the basin,

small amounts (less than 100 AFY) of groundwater could spill into the adjacent Temecula-Murrieta Basin (MWH, 2003a).

**Table 16-2**
**Summary of Management Agencies in the Elsinore Basin**

| Agency | Role |
|---|---|
| Elsinore Valley Municipal Water District | Primary producer and basin manager. |
| Elsinore Water District | Participates in basin monitoring. |
| Santa Ana Water Project Authority (SAWPA) | Joint Powers Authority established to plan and build facilities to protect the water quality of the Santa Ana River Watershed. |
| California Regional Water Quality Control Board – Santa Ana Region (Regional Board) | Issuance of permits for discharges to Canyon Lake, Lake Elsinore, Temescal Wash and Back Basin Injection Project. |
| Western Municipal Water District | Provider of imported water from Metropolitan for municipal supply and injection. |
| Eastern Municipal Water District | Provider of recycled water for recharge to Lake Elsinore. |

## WATER SUPPLY FACILITIES AND OPERATIONS

The two primary water producers in the basin are EVMWD and Elsinore Water District (EWD). The following provides a summary of the facilities within the Elsinore Basin.

### Active Production Wells

There are 10 active production wells in the Elsinore Basin with an estimated capacity of approximately 13 MGD or about 15,000 AFY (MWH, 2003b; MWH, 2006). Data for the wells are summarized in **Table 16-3**. Fourteen additional wells are planned to address peaking issues in the basin (MWH, 2003a). These wells are used primarily for municipal demand. **Figure 16-4** shows the production in the Elsinore Basin between 1985 and 2004. An average of approximately 7,800 AFY was produced from the basin between 1985 and 2004. Production has increased over the past few years – the average production for the past 3 years has been nearly 9,900 AFY. Groundwater production in the basin has exceeded the safe yield of the basin in nearly every year since 1985.

Operation costs for the wells in Elsinore Basin range from about $100 to $130 per AF (EVMWD, 2006).

### Other Production

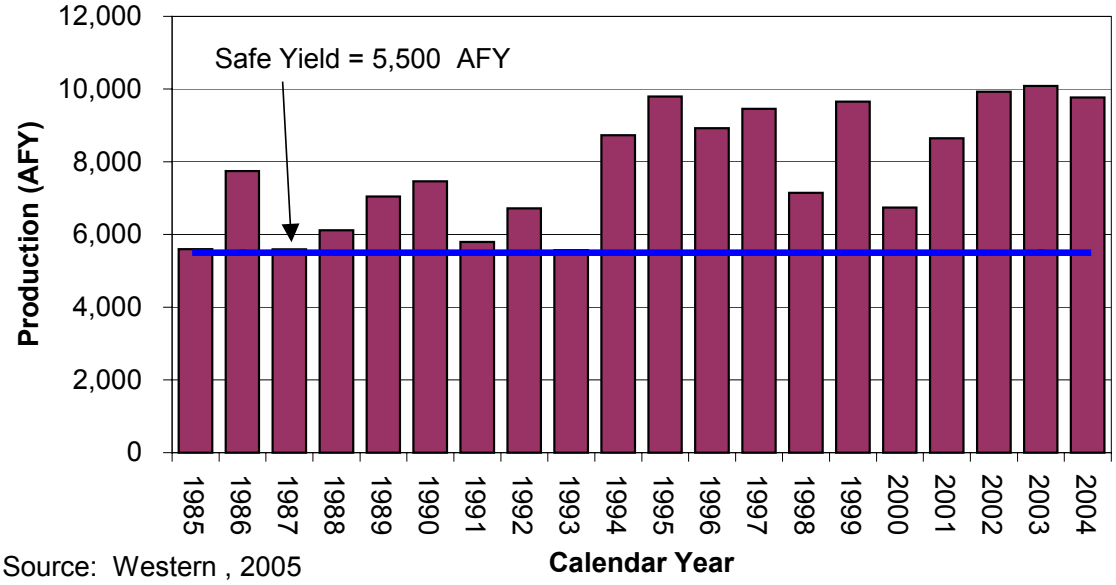
Private pumpers are estimated to pump a cumulative of approximately 100 AFY (MWH, 2003a).

**Table 16-3**
**Summary of Production Wells in the Elsinore Basin**

| Category | Number of Active Wells [1] | Estimated Production Capacity [2] (AFY) | Average Production 1985-2004 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| Municipal Wells | 10 | 15,000 | 7,800 | $100 to $130 |
| Private Wells | Unknown | 100 | 100 | |
| Total | 10 | 15,100 | 7,900 | |

Source: Western MWD (2005)
3. Active wells have production within past 5 years
4. Estimated production capacity is estimated by MWH, 2003a and 2006

**Figure 16-4**
**Historical Groundwater Production in the Elsinore Basin**




Source: Western , 2005

### ASR Wells

EVMWD has recently retrofitted four of their existing wells to aquifer storage and recovery (ASR) and constructed one new injection well in the Back Basin. Estimated injection capacity is approximately 7.5 MGD, or about 8,500 AFY (MWH, 2006). EVMWD is currently considering constructing an additional two to three ASR wells in the Back Basin area with a combined injection capacity of 4 MGD.

EVMWD conducted a pilot injection test in the Back Basin in 2002 and 2003. Approximately 175 AF of treated imported water from Metropolitan was injected during this pilot test.

**Table 16-4**
**Summary of ASR Wells in the Elsinore Basin**

| Category | Number of ASR Wells | Estimated Injection Capacity [1] (AFY) | Average Injection 1985-2004 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| Existing | 5 | 8,500 | <10 | Not available |
| Future | 2 to 3 | 4,400 | 0 | |
| **Total** | **7 to 8** | **12,900** | **<10** | |

[1]Source: MWH, 2006

### Spreading Basins

The Elsinore Basin does not currently contain any spreading basins. The Riverside County Flood Control and Conservation District maintains two debris basins in Leach and McVicker Canyons on the northwestern side of the basin for flood control. The amount of runoff infiltrated into groundwater from these basins is not calculated.

### Seawater Intrusion Barriers

There are no seawater intrusion barriers in the Elsinore Basin.

### Desalters

There are no desalters in the Elsinore Basin.

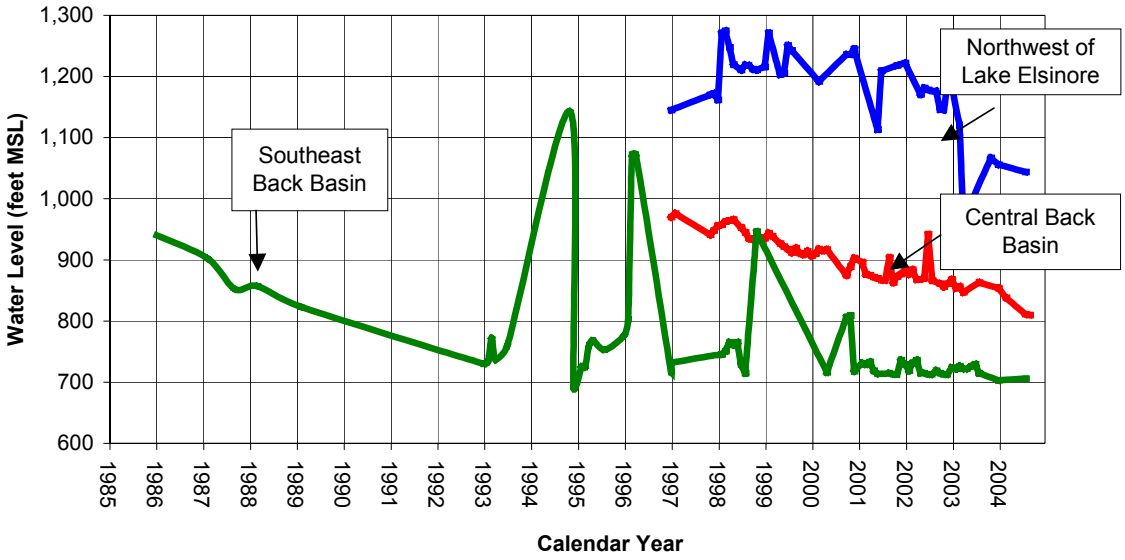
## GROUNDWATER LEVELS

In concert with the water management plan, EVMWD adopted a groundwater-monitoring plan in 2004 to monitor groundwater levels in the basin. EVMWD and EWD currently measure water levels and water production on a monthly basis. There are currently four multi-level

groundwater monitoring wells in the Back Basin and three monitoring wells in the areas downstream of Leach and McVicker Canyons.

Historical groundwater levels in the Elsinore Basin are plotted in **Figure 16-5**. Groundwater generally flows from the northwest to southeast beneath Lake Elsinore. The difference between groundwater levels on the northwest side and the southeast side is more than 300 feet. Depth to water currently ranges from about 250 feet in the northwest to more than 600 feet in the southeast.

**Figure 16-5**
**Historical Water Levels in the Elsinore Basin**




Groundwater levels are generally declining throughout the basin. Average declines have been about 15 feet per year throughout the basin over the past 20 years. This decline in water levels increases the risk for land subsidence particularly in the Back Basin area. EVMWD is currently in the process of implementing a subsidence-monitoring program.

## GROUNDWATER QUALITY

The groundwater in the Elsinore Basin is generally of good to fair quality with total dissolved solids (TDS) concentrations ranging from 250 mg/L in the Back Basin area east of Lake Elsinore to about 600 mg/L in the northwest part of the basin (SAWPA, 2006).

### Groundwater Quality Monitoring

Groundwater quality samples are collected from active production wells in accordance with California DHS requirements as specified in Title 22 of the California Code of Regulations. As

discussed above, EVMWD adopted a groundwater-monitoring plan in 2004. Under this plan, EVMWD would collect samples from each of its production wells annually and its monitoring wells twice annually for Title 22 constituents. Other activities in the monitoring plan are depth-specific zone sampling, surface water sampling, spinner logging and subsidence monitoring.

The Santa Ana Watershed Basin Monitoring Task Force is a collaborative effort of public and private sector agencies and interests. As part of this effort, SAWPA compiles water quality data in the Santa Ana River Watershed, including total dissolved solids (TDS) and nitrate (as N) data. SAWPA also prepares a triennial update of the ambient groundwater quality throughout all the groundwater basins in the Santa Ana River Watershed.

**Groundwater Contaminants**

Primary constituents of concern for the Elsinore Basin are TDS, nitrate and arsenic. Each is discussed in more detail below. Data are summarized in **Table 16-5**.

The ambient 20-year (1984 to 2003) average TDS concentration for the Elsinore Basin is 460 mg/L. Ambient concentrations of TDS have decreased about 20 mg/L in the Elsinore Basin compared to the 1978 to 1997 average (Wildermuth, 2005). TDS concentrations have ranged from about 250 mg/L in the Back Basin area to above 600 mg/L northwest of Lake Elsinore (MWH, 2003a).

Nitrate concentrations range from non-detect in the Back Basin area to as much as 8 mg/L along the southern margin of the basin. Sources of nitrate in these areas are a result of historical agricultural practices and septic tanks in the shallower portions of the basin to the south. About 3,900 parcels are currently using septic systems, which create a high risk for nitrate contamination of groundwater. Nitrate concentrations in these areas are currently increasing. Two current production wells are located within the high-risk areas for future nitrate contamination (MWH, 2003a). The 20-year average ambient nitrate concentrations (1984 to 2003) are about 2.4 mg/L (Wildermuth, 2005).

Concentrations of arsenic range from non-detect in the northwestern portions of the Elsinore Basin to as much as 35 mg/L in the Back Basin area and exceed the primary MCL for arsenic. The highest concentrations of arsenic are found in the deeper zones of the basin. (MWH, 2003a).

**Blending Needs**

Blending of some wells in the Back Basin area is required to meet the arsenic MCL. These wells are currently blended with other wells in the EVMWD system and imported water from Metropolitan. EVMWD is currently in final design for a 5 MGD arsenic treatment plant to be online in 2007 (EVMWD, 2006a).

**Table 16-5**
**Summary of Constituents of Concern in the Elsinore Basin**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL=500 | mg/L | 250 to >600<br>Ambient: 460 | TDS concentrations range from about 250 mg/L in the Back Basin area to above 600 mg/L northwest of Lake Elsinore. |
| **Nitrate (as N)**<br>Primary MCL =10 | mg/L | ND to 8<br>Ambient:2.4 | Nitrate concentrations range from non-detect in the Back Basin area to as much as 8 mg/L along the southern margin of the basin. Nitrate concentrations in areas where septic tanks exist are currently increasing. |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL:<br>TCE = 5<br>PCE =5 | µg/L | ND | TCE and PCE have not been detected in the Elsinore Basin |
| **Perchlorate**<br>Notification level =6 | µg/L | ND | Perchlorate has not been detected in the Elsinore Basin. |
| **Arsenic**<br>Primary MCL = 10 | µg/L | ND to 35 | Concentrations of arsenic range from non-detect in the northwestern portions of the basin to as much as 35 mg/L in the Back Basin area and exceed the primary MCL for arsenic. The highest concentrations of arsenic are found in the deeper zones of the basin |

**Groundwater Treatment**

Wells in the Elsinore Basin are not currently treated for any constituent of concern discussed above. Since July 2005, the Elsinore Valley Municipal Water District has been upgrading its drinking water disinfection process. Chloramine disinfection will replace the current chlorine disinfection (EVMWD, 2006b).

EVMWD is currently in final design for a 5 MGD arsenic treatment plant to be online in 2007. Estimated cost of treatment is projected to be approximately $84 to $100 per AF (EVMWD, 2006).

## CURRENT GROUNDWATER STORAGE PROGRAMS

In 2006, Western MWD and EVMWD executed a conjunctive use program (Elsinore CUP) with Metropolitan. The Elsinore CUP allows Metropolitan to store up to 12,000 AF in the Elsinore Basin to be produced upon Metropolitan's call in-lieu of imported supplies at the service

connection during water shortage events (up to 4,000 AFY). At the end of 2005/06, the account balance in this program was 0 AF.

**BASIN MANAGEMENT CONSIDERATIONS**

Considerations related to basin management in the Elsinore Basin include:

- EVMWD is required by the City of Lake Elsinore to provide water to maintain water levels in Lake Elsinore. Currently, groundwater is used for lake augmentation. On average, about 3,200 AFY is needed to maintain lake levels in Lake Elsinore. As much as 12,500 AFY would be necessary during a dry year.

- Groundwater levels are declining, which could limit future extraction.

- Nitrate concentrations are increasing in some areas and affected areas could enlarge in the future.

- As water levels continue to decline, there is a potential for land subsidence, particularly in the Back Basin area.

- Water quality issues could limit storage potential. Arsenic concentrations exceed drinking water standards in some areas. Wells are currently blended to meet drinking water standards.

- Water demands are projected to nearly double by 2020 (MWH, 2003a). Only about 20 percent of the demand in the future could be met by groundwater.

- Geologic faulting within the basin may significantly limit storage and extraction operations.

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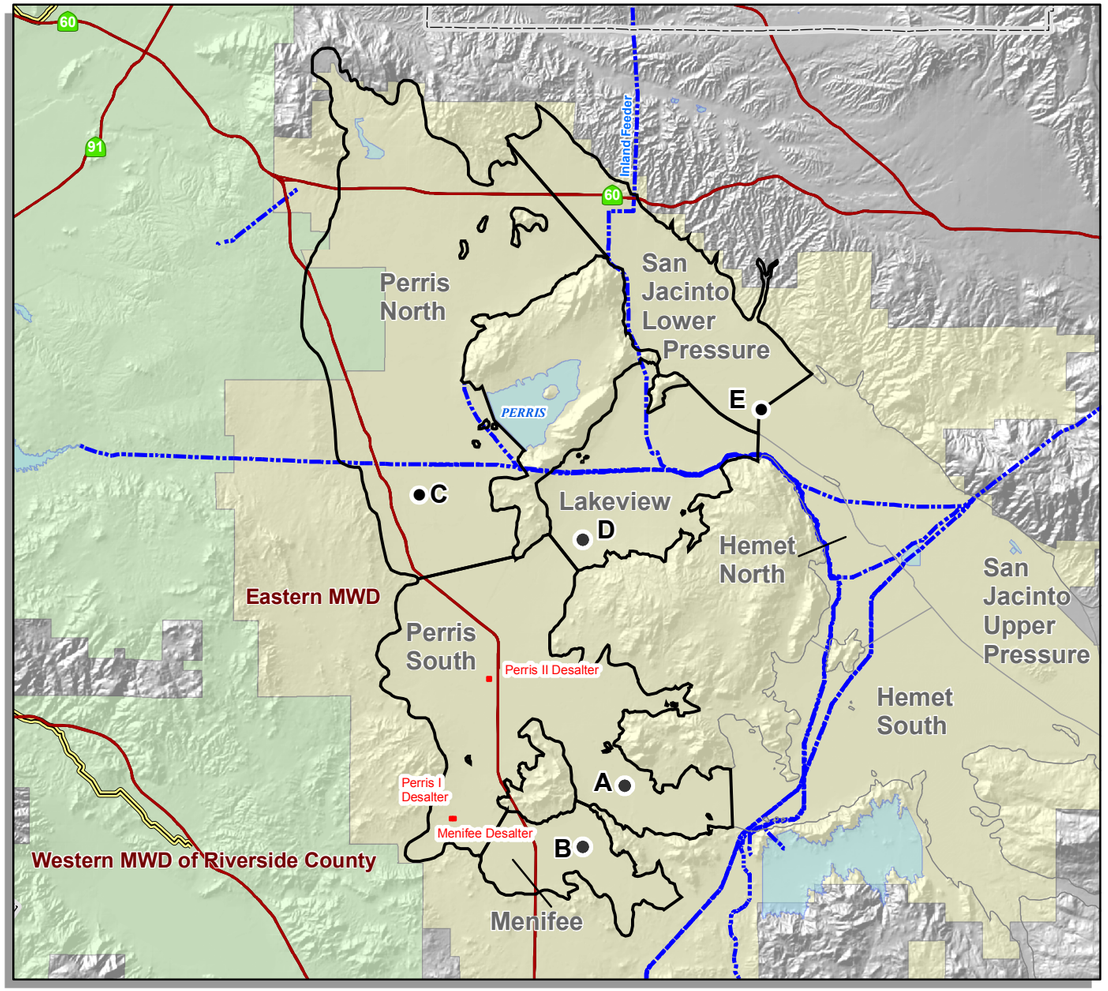


## West San Jacinto Basins

A ● Key well
Desalter
County
Freeways
Water Body
MWD Pipeline
Santa Ana Regional Interceptor Line
Adjacent Basin
Basin
MWD Member Agency Boundary (color varies)

N W E S

2.5 1.25 0 2.5 Miles

Note: This map was prepared by the Metropolitan Water District of Southern California for its own use. No warranty is expressed or implied as to the correctness, timeliness, or content of the information shown herein.

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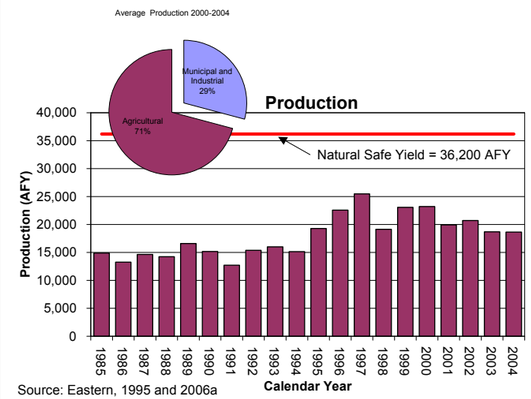
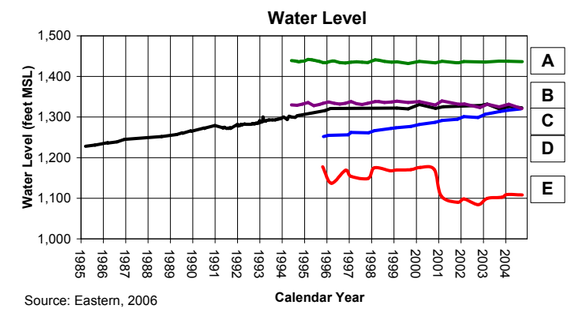
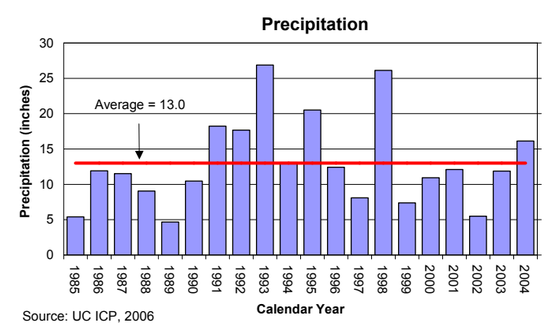
Additional Data Sourse(s): Santa Ana Watershed Project Authority (SAWPA); California Spatial Information Library (CaSIL).




Source: Eastern, 1995 and 2006a




Source: Eastern, 2006




Source: UC ICP, 2006

**Direct Recharge**
**Incidental recharge from recycled ponds only.**

### BASIN FACTS

**West San Jacinto Basins**

**Description**
**Location:** Riverside County
**Watershed Surface Area:** 148 square miles
**Subbasins:**
Perris North
Perris South
San Jacinto Lower Pressure
Lakeview
Menifee
**Management:** Managed
Basin is currently managed. Eastern MWD adopted a Groundwater Management Plan in 1995
**MWD Member Agencies:**
Eastern MWD
Western MWD

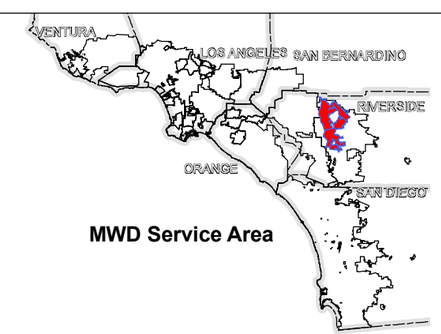
| | West San Jacinto |
|---|---|
| **Natural Safe Yield** | 36,200 AFY |
| **Operational Safe Yield** | 48,100 AFY |
| **Total Storage** | 1.8 million AF |
| **Unused Storage Space (2000)** | 700,000 AF |
| **Portion of Unused Storage Space Available for Storage** | ~200,000 AF |

**Storage and Extraction Facilities**

| | West San Jacinto |
|---|---|
| **Production Wells** | |
| Production Capacity | ~26,000 AFY |
| Average 1985-2004 | ~18,000 AFY |
| **Injection Wells** | |
| Injection Capacity | None |
| Average 1985-2004 | None |
| **Spreading Basins** | |
| Spreading Capacity | None |
| Average 1985-2004 | None |

**Basin Management Considerations**

- Poor water quality could limit storage and extraction potential




**MWD Service Area**

**Plate 17-1**
**Overview of West San Jacinto Basins**

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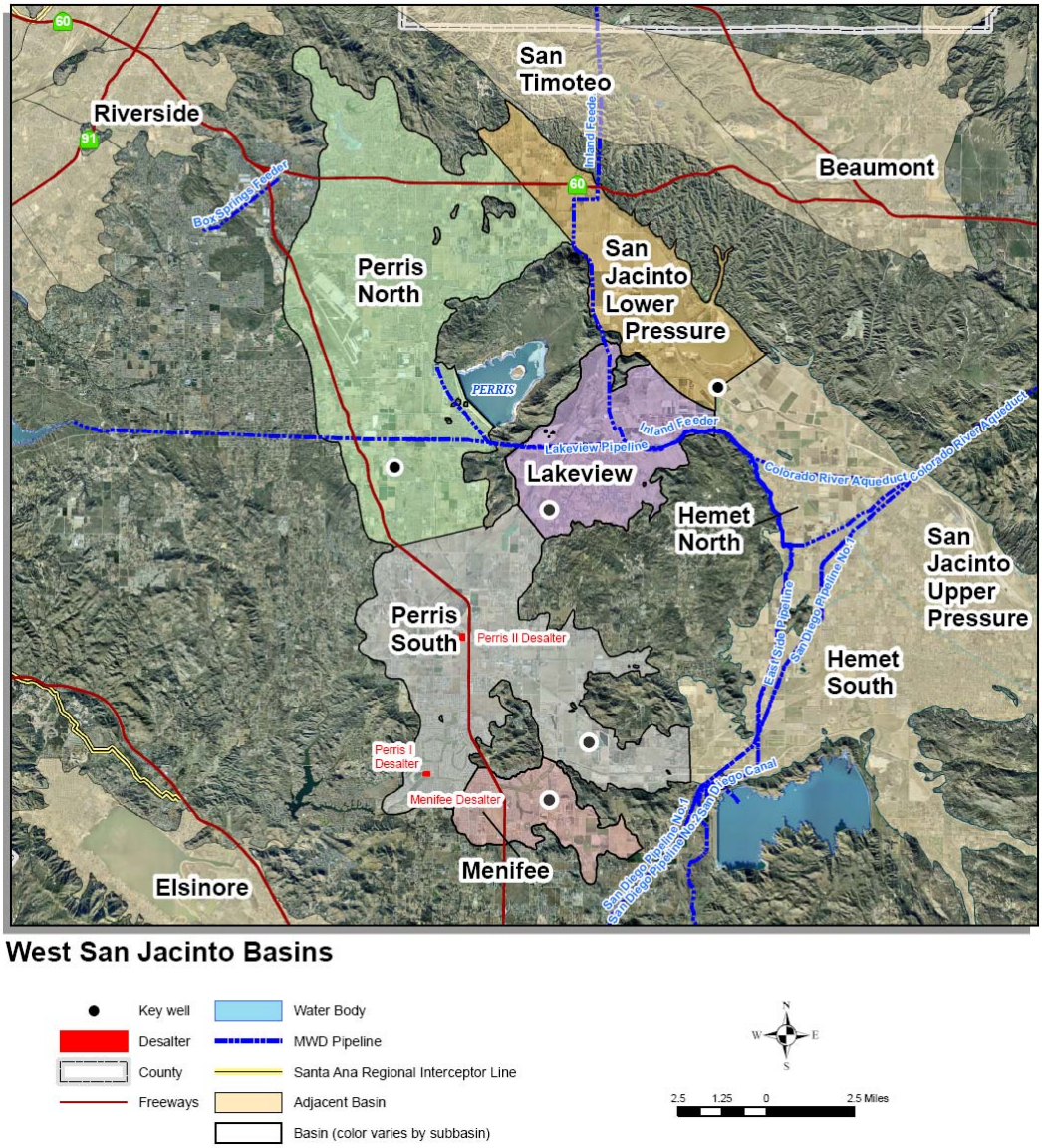
The West San Jacinto Basins are located within the western portion of the San Jacinto River watershed in Riverside County. The West San Jacinto Basins underlie the service area of Metropolitan member agencies Eastern Municipal Water District (Eastern MWD) and a minor portion of Western Municipal Water District (Western MWD), and are divided into five basins, or management zones (Perris North, Perris South, San Jacinto Lower Pressure, Lakeview, and Menifee). The West San Jacinto Basins are utilized for groundwater supply for the cities of Perris, Moreno Valley, and Sun City; unincorporated areas of Menifee, Juniper Flats, Sunnymead, Edgemont, Romoland, Homeland, Mead Valley, Quail Valley, and Winchester. A map of the West San Jacinto Basins is provided in **Figure 17-1**.

**Figure 17-1**
**Map of the West San Jacinto Basins**



## BASIN CHARACTERIZATION

The following section provides a physical description of the West San Jacinto Basins, including geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

Groundwater occurrence in the West San Jacinto Basins is generally within unconfined alluvium. As described above, the West San Jacinto Basins are divided into five subbasins that are differentiated by physical constrictions such as bedrock highs, narrows and faults between the zones or water quality variations. Hydrogeologic parameters for each subbasin are summarized in **Table 17-1** and discussed below.

**Table 17-1**
**Summary of Hydrogeologic Parameters of West San Jacinto Basins**

| Parameter Structure | Description |
|---|---|
| Aquifer(s) | Unconfined alluvium |
| Depth of groundwater basin | Perris North: Up to 850 feet<br>Perris South: Up to 1,000 feet<br>Lakeview: More than 1,000 feet<br>Menifee: Up to 900 feet<br>San Jacinto Lower Pressure: Up to 1,200 feet |
| Depth of producing zones or screen intervals | Perris North: 250 to 700 feet<br>Perris South: 100 to 350 feet (desalter wells)<br>200 to 600 feet (southeast)<br>Lakeview: 300 to 1,000 feet<br>Menifee: 100 to 600 feet<br>San Jacinto Lower Pressure: Data not available |
| **Yield and Storage** | |
| Natural Safe Yield | 36,200 AFY |
| Operational Safe Yield | 48,100 AFY |
| Total Storage | 1.8 million AF |
| Unused Storage Space (2000) | 700,000 AF |
| Portion of Unused Storage Space Available for Storage | ~200,000 AF (Lakeview only) |

Source: Eastern MWD, 1995, 2005b, and 2006

Total depth of the West San Jacinto Basins ranges from about 40 feet to 1,350 feet. The deepest basins are the Lakeview and San Jacinto Lower Pressure subbasins with total depths over 1,000 feet. The San Jacinto Lower Pressure subbasin has alluvium to about 1,200 feet in depth, although it is comprised mostly of clays and silts and produces little water. Maximum depths in the other basins range from 600 to 900 feet. Producing zones range in depth from 100 to 1,000 feet.

Total storage within the West San Jacinto Basins has been estimated to be approximately 1.8 million AF (Eastern MWD, 2005b). In 2000, there was an estimated 1.1 million AF in storage, or about 700,000 AF in unused storage space (Eastern MWD, 2005b). Within the West San Jacinto Basins, Lakeview is the only subbasin with available unused storage capacity. About 200,000 AF of the unused storage space is available for additional storage (Eastern MWD, 2006a). Storage in the subbasins other than Lakeview is not useable due to poor water quality.

**Safe Yield/Long-Term Balance of Recharge and Discharge**

The natural safe yield is estimated to be approximately 36,200 AFY (Eastern MWD, 2005b), which represents the yield of the basin without artificial recharge. If artificial recharge is included, the yield of the basin increases to about 48,100 AFY (Eastern MWD, 2005b).

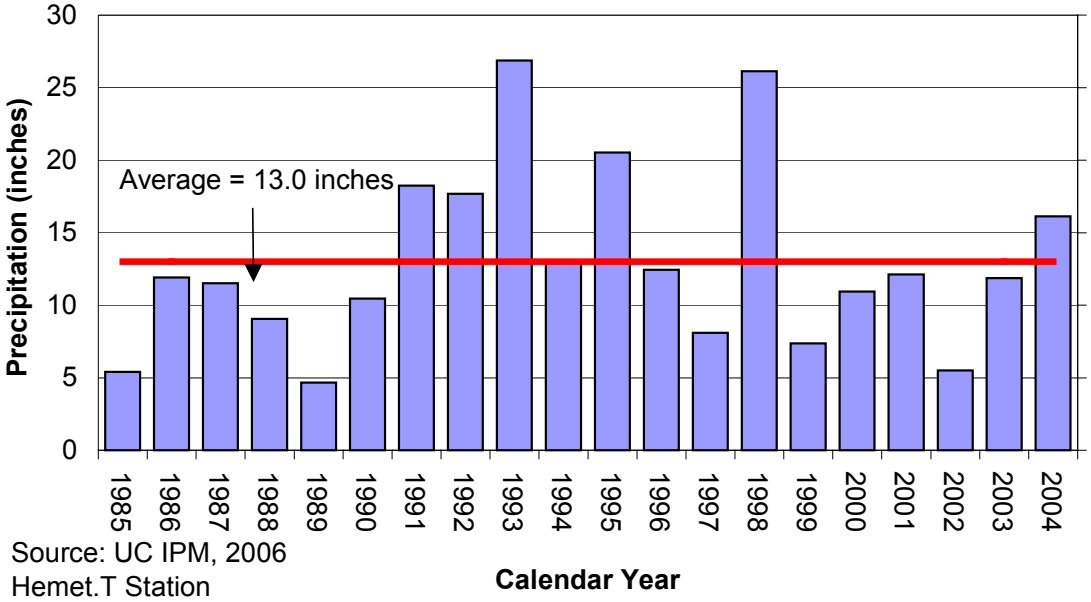
Sources of recharge in the West San Jacinto Basins consist of: percolation of stormwater runoff, precipitation, applied water, artificial recharge, and subsurface inflows from adjacent areas. Total natural inflows are estimated to be about 38,200 AFY (Eastern MWD, 2005b), more than 50 percent of which is a result of deep percolation of agricultural returns. Average recharge from stormflow percolation and runoff from the mountains is estimated to be about 11,500 AFY, or about 30 percent of the total inflows (Eastern MWD, 2005b). Deep percolation of precipitation also recharges the groundwater in the basin. Average historical precipitation in the area has been about 12 inches. However, over the 20-year period from 1985 to 2004 the average was slightly above with historical average at 13 inches as shown on **Figure 17-2** (CIMIS 2006). Annual evapotranspiration in the area is about 50 inches and, therefore, deep percolation of rainfall only occurs during wet years. The long-term recharge from precipitation in the West San Jacinto Basins is estimated to be about 6,400 AFY (Eastern MWD, 2005b).

Primary outflows include outflow to the Hemet-San Jacinto Basins to the east and groundwater production. About 2,000 AFY flows from the West San Jacinto Basins to the Hemet-San Jacinto Basins.

## GROUNDWATER MANAGEMENT

The following section describes how the West San Jacinto Basins are currently managed. It includes a description of the governing structure within the basins and agreements with adjacent basins.

**Figure 17-2**
**Historical Precipitation in the West San Jacinto Basins**




Source: UC IPM, 2006
Hemet.T Station

**Basin Governance**

The West San Jacinto Basins are managed by Eastern MWD under the authority of the West San Jacinto Groundwater Basin Management Plan (Management Plan), which was cooperatively developed and adopted in 1995 under Assembly Bill 3030. Elements of the Management Plan include: artificial recharge, recovery of degraded groundwater to be blended with imported water, recovery of brackish water using demineralization treatment technologies, conjunctive use, and agricultural groundwater exchange. The managing agencies and their roles in groundwater management in the West San Jacinto Basins are summarized in **Table 17-2**.

The Management Plan also established an advisory committee that oversees management activities in the basin. Advisory committee members include the Nuevo Water Company, the cities of Moreno Valley and Perris, the McCanna Ranch Water Company, and two elected representatives from the private water producers.

**Interactions with Adjoining Basins**

Depending on groundwater levels, groundwater may flow between the Hemet-San Jacinto Basins to the east and southeast. This basin interaction primarily occurs between the San Jacinto Lower Pressure subbasin and the Lakeview subbasin of the West San Jacinto Basins and the San Jacinto Upper Pressure and Hemet North subbasins of the Hemet-San Jacinto Basins to the south. Flow can also occur between the Perris South and Menifee subbasins and the Hemet South subbasin of the Hemet-San Jacinto Basins to the east. These flows are not regulated and there are no formal agreements regarding these flows.

**Table 17-2**
**Summary of Management Agencies in West San Jacinto Basins**

| Agency | Role |
|---|---|
| Eastern MWD | Basin Manager<br>Implementation of water resources management projects (desalters, water treatment facilities, etc).<br>Implementation of groundwater monitoring programs<br>Member of Advisory Committee<br>Retail and wholesale water sales<br>Groundwater producer<br>Operation of wastewater treatment and recycled water facilities |
| Nuevo Water Company | Member of Advisory Committee<br>Groundwater producer |
| City of Moreno Valley | Member of Advisory Committee |
| City of Perris | Member of Advisory Committee<br>Groundwater producer |
| McCanna Ranch Water Company | Member of Advisory Committee<br>Groundwater producer |

## WATER SUPPLY FACILITIES AND OPERATIONS

The following section describes the water supply facilities within the West San Jacinto Basins. Facilities currently include 16 active municipal production well, 57 agricultural wells, about 340 acres of reclaimed water ponds and 3 desalters.

### Municipal Production Wells

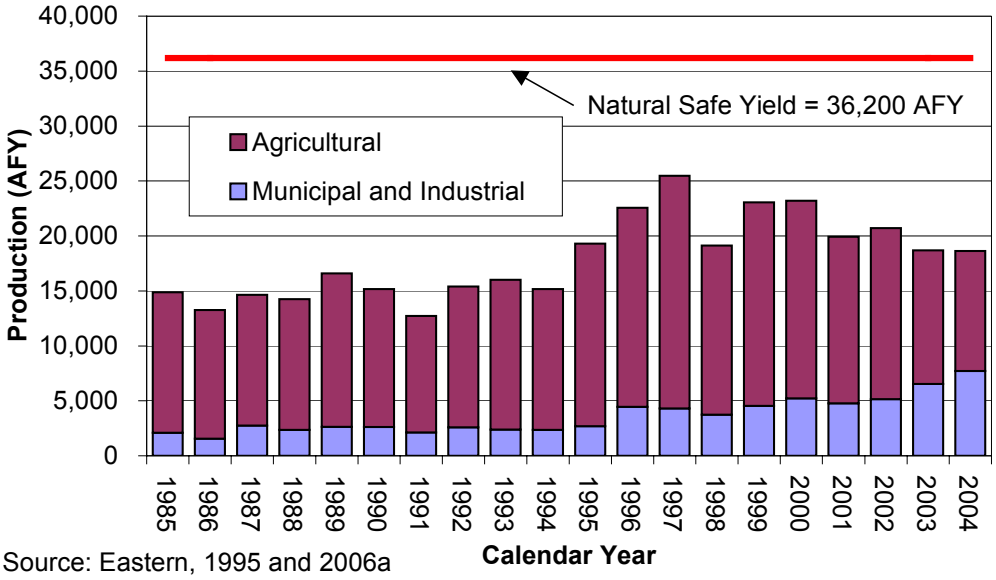
According to Eastern MWD, there are 16 active municipal production wells in the West San Jacinto Basins. Details of the production wells are provided in **Table 17-3**. **Figure 17-3** shows historical groundwater production between 1985 and 2004. Between 1985 and 1994, the percent of the total production attributed to municipal production was relatively small (averaging 15 to 16 percent). After 1995, with increasing shift from agricultural to urban land use and implementation of the Management Plan, the amount and relative percent of municipal production increased to an average of about 23 percent between 1995 and 2004.

**Table 17-3**
**Summary of Production Wells in the West San Jacinto Basins**

| Category | Number of Active Wells | Estimated Production Capacity [1] (AFY) | Average Production 1985-2004 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| Municipal | 16 | 7,710 | 3,626 | Regular wells $56 Desalter wells $83 |
| Agricultural | 57 | 17,974 | 14,310 | Data not available |
| **Total** | **73** | **25,684** | **17,936** | **-** |

Note: 1 Production capacity is based upon maximum annual production in past 5 years

**Figure 17-3**
**Historical Groundwater Production in the West San Jacinto Basins**




Source: Eastern, 1995 and 2006a

As shown in **Figure 17-3**, groundwater production in the West San Jacinto Basins generally decreased from a high of more than 25,000 AFY in 1997 to about 18,600 AFY in 2004. Most of this reduction is due to decreasing production from the Perris North and Lakeview subbasins. Total production levels are relatively low when compared with the estimated safe yield. This limited utilization of the groundwater is primarily due to the generally poor quality of the groundwater in a large proportion of the West San Jacinto area, such as the Perris South and

Menifee subbasins and in portions of the Perris North and Lakeview subbasins as discussed in more detail below.

**Other Production**

Non-municipal production is entirely for agricultural purposes from 57 wells. As summarized in **Figure 17-3**, between 1985 and 1994, agricultural production ranged from 81 to 88 percent of the total production. After 1995, with increasing shift from agricultural to urban land use the agricultural production decreased to about 60 percent of the total groundwater production in 2004.

**ASR Wells**

There are no ASR wells in the West San Jacinto Basins.

**Spreading Basins**

There are no spreading basins located in the West San Jacinto Basins used specifically for groundwater recharge. Recycled water storage ponds, though, contribute incidental recharge. There are about 340 acres of ponds used for regional water reclamation facilities in the Perris South area.

**Seawater Intrusion Barriers**

There are no seawater intrusion barriers in the West San Jacinto Basins.

**Desalters**

As part of the Management Plan, and with the help of funding through Metropolitan's Groundwater Recovery Program (GRP), Eastern MWD has implemented a Groundwater Salinity Management Program to reduce the total dissolved solids (TDS) concentrations in the Menifee and Perris South subbasins. This program consists of three desalination facilities. Specifically, the Menifee and the Perris I desalters are in operation, and the Perris II desalter is in design. The Menifee Desalter came online in 2001. The Perris I desalter came online in 2005. These facilities recover high-TDS water and treat it for potable use. The two online desalters produce 3 to 7 MGD of potable water. The desalters are a source of water, and help to decrease dependency on imported water. However, another role of the desalters is to call attention to and address the migration of brackish groundwater into areas of good quality groundwater (Eastern MWD, 2006). The locations of the desalters are shown in **Figure 17-1**.

## GROUNDWATER LEVELS

Under the Management Plan Groundwater Monitoring Program, water levels in municipal and private agricultural wells are measured twice per year, in the spring and fall (Eastern MWD, 2006). There were 135 wells with groundwater level measurements in both 2003 and 2004. In spring 2005, groundwater level measurements were recorded for 158 wells. In

addition, water levels for another 404 wells (mostly monitoring wells) were reported to Eastern MWD by March Air Reserve Base (Eastern MWD, 2006).

According to Eastern MWD, the depth to groundwater within the West San Jacinto Basins ranges between 10 to 346 feet below ground surface (Eastern MWD, 2006). **Figure 17-4** shows groundwater elevations within the West San Jacinto Basins subbasins during early 2005.

Groundwater elevations range from above 1,700 feet MSL in the San Jacinto Lower Pressure area to less than 1,200 feet MSL in the Lakeview area. In general, groundwater flow directions are highly variable and largely dependent upon local pumping depressions and hydrogeologic structure. For example, groundwater flow is generally from northwest to southeast in the San Jacinto Lower Pressure subbasin and northern portion of the Perris North subbasin Groundwater flow is toward the east in the southern portion of the Perris North subbasin and most the Perris South subbasin. Groundwater flow is generally toward the west in the Lakeview and Menifee subbasin. It important to note that groundwater flows from the northern portion of the Perris South subbasin into the Lakeview subbasin, allowing poorer quality water of the Perris South subbasin to enter the higher quality Lakeview subbasin. This issue is discussed in more detail below.

Historical water levels from representative wells in the West San Jacinto Basins are shown on **Figure 17-5**. Water levels have remained relatively stable in the Perris South and Menifee subbasins since 1995, while water levels have increased in the Perris North and Lakeview subbasins (largely due to decreased production) and decreased in the San Jacinto Lower Pressure subbasin. The cause of the decreased water levels in the San Jacinto Lower Pressure subbasin is unknown.

## GROUNDWATER QUALITY

The following section describes the groundwater quality within the West San Jacinto Basins. In general, groundwater quality in the West San Jacinto Basins is fair to poor with total dissolved solids (TDS) concentrations exceeding 10,000 mg/L in some areas.

### Groundwater Quality Monitoring

Water quality samples are collected once a year under the West San Jacinto Groundwater Management Plan's Groundwater Monitoring Program (Eastern MWD 2005b and 2006). These samples are usually collected in the summer from all available municipal and private (agricultural) wells. In 2005, 102 water quality samples (general mineral and nitrogen) were collected (Eastern MWD, 2006).

**Figure 17-4**
**Groundwater Contour Map for the West San Jacinto Basins – Spring 2005**

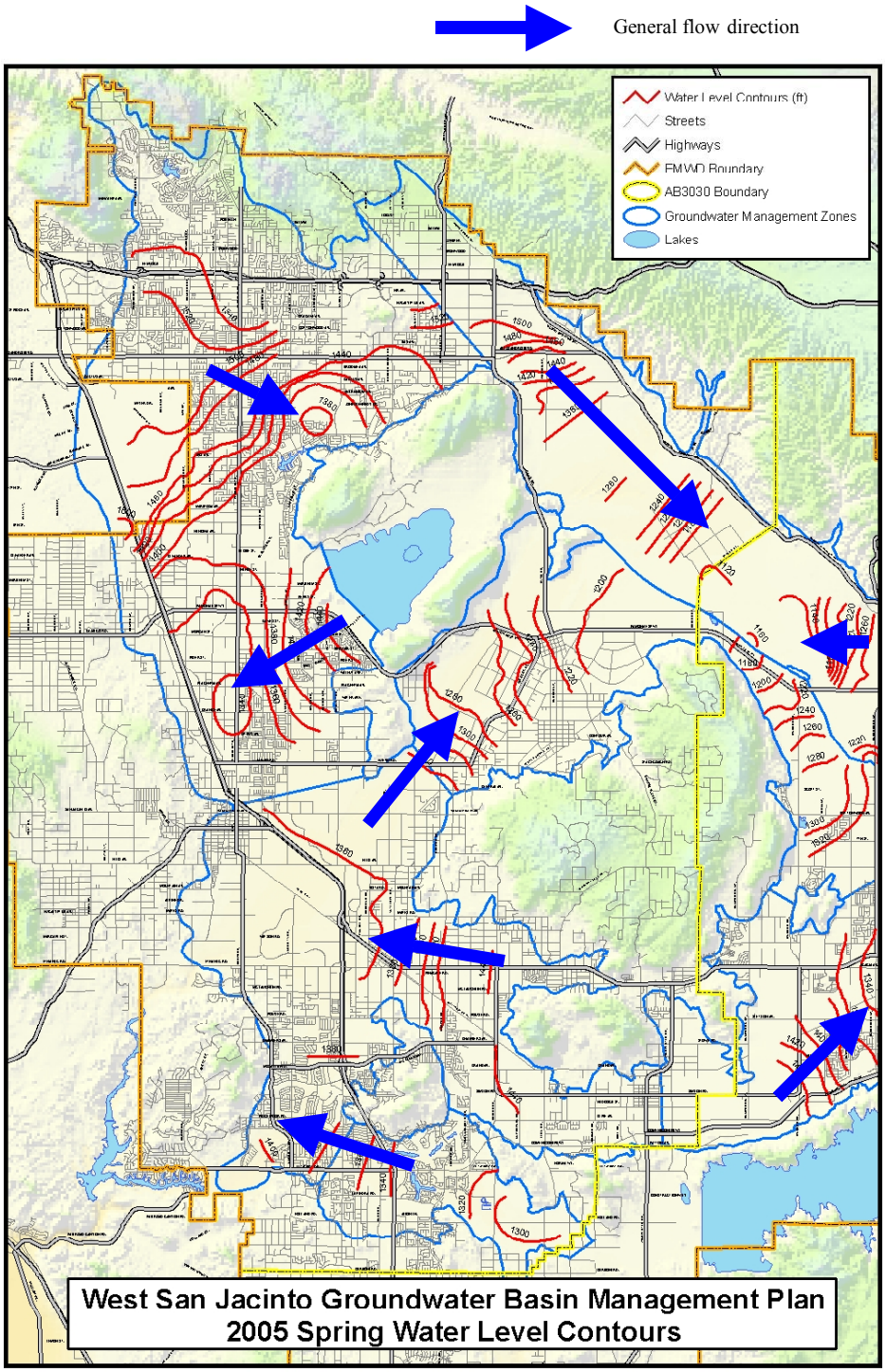
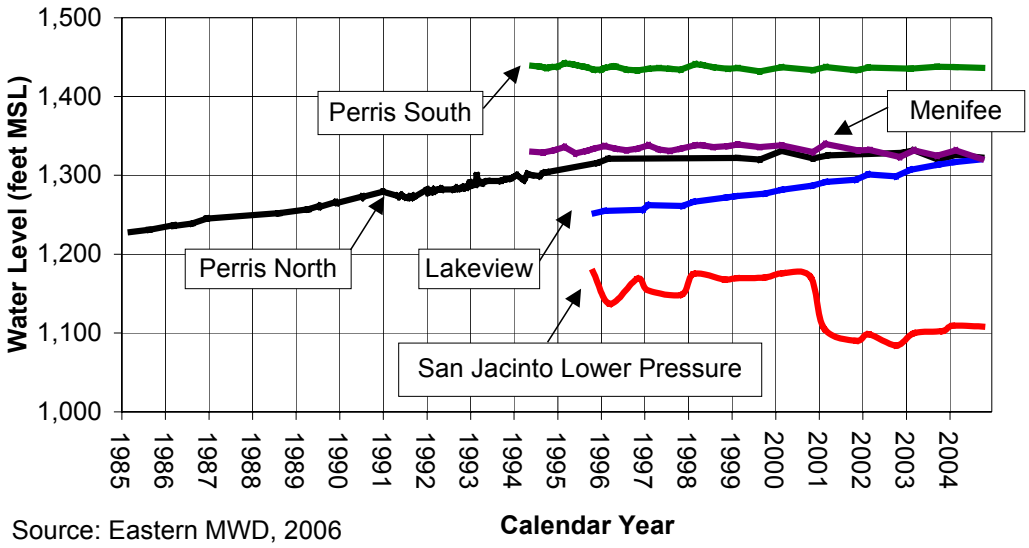


**Figure 17-5**
**Historical Water Levels in the West San Jacinto Basins**




Source: Eastern MWD, 2006

## Groundwater Contaminants

**Table 17-4** summarizes the constituents of concern in the West San Jacinto Basins. These include TDS, nitrate, volatile organic compounds (VOCs), perchlorate, iron and manganese. Water quality in the West San Jacinto Basins is generally poor, particularly in the Perris South, Menifee and San Jacinto Lower Pressure subbasins. The water with the highest TDS level (10,100 mg/L) was found in the southwest portion of the Perris South subbasin. The lowest TDS concentration of 220 mg/L was found in the northwest portion of the Perris North subbasin. **Figures 17-6 and 17-7** show 2005 concentrations of TDS and nitrate (as N), respectively.

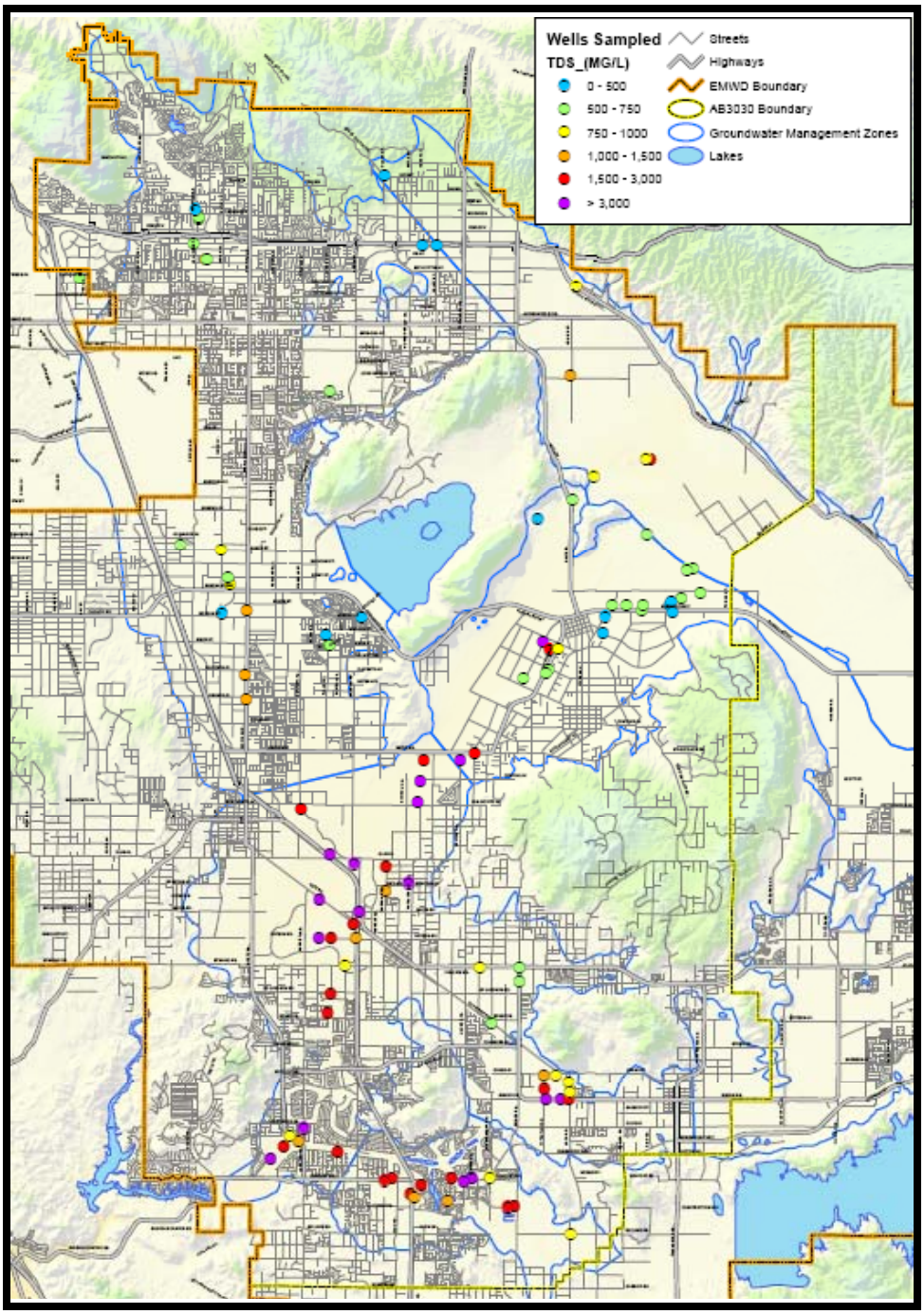
The groundwater resources of the Lakeview subbasin have been relied upon for irrigation and domestic water supply uses since the early part of the twentieth century. Although as seen in **Figure 17-5**, groundwater levels since 1995 have been rising in the Lakeview subbasin, historically significant groundwater level declines and water quality degradation have occurred. In the early 1960s, basin flow patterns changed as a result of excessive pumping in the Lakeview subbasin and groundwater flowed from the Perris South subbasin to the Lakeview subbasin. This change resulted in the intrusion of poor quality groundwater (high TDS) from the Perris South subbasin into areas previously containing good quality water. The poor quality water plume now extends more than two miles into the Lakeview subbasin. This reversal in the hydraulic gradient and the intrusion of poorer quality water into the Lakeview subbasin has resulted in the loss of use of production wells, depletion of groundwater reserves, and higher pumping costs. As discussed above, one of the purposes of the Perris Desalter Program is to reverse the migration trend of the poorer quality groundwater into the Lakeview subbasin. (Eastern MWD, 2006a)

**Table 17-4**
**Summary of Constituents of Concern in the West San Jacinto Basins**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL = 500 | mg/L | **Lakeview**<br>360 to 4,360<br>**Perris North**<br>220 to 1,310<br>**Perris South**<br>580 to 10,100<br>**San Jacinto L. Pressure**:<br>260 to 1,870<br>**Menifee**<br>910 to 3,680 | Values reported are summarized from the 2005 Water Quality Monitoring Program for 102 wells |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/L | **Lakeview**<br>ND to 21<br>**Perris North**<br>ND to 23<br>**Perris South**<br>ND to 18<br>**San Jacinto L. Pressure**<br>ND to 8<br>**Menifee**<br>ND to 10 | Values reported are summarized from the 2005 Water Quality Monitoring Program for 102 wells |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL for TCE = 5<br>Primary MCL for PCE = 5 | µg/L | PCE: 1.5 to 7.9<br>TCE: 1.5 to 1.7 | PCE detected in Eastern MWD's Moreno Valley Wells 44 and 49; TCE detected in Eastern MWD's Perris Valley Well 56. VOC plumes occur at March Air Reserve Base |
| **Perchlorate**<br>Notification level = 6 | µg/L | 5 to 11 | Detected in Eastern MWD's Moreno Valley Wells 44 and 49 |
| **Iron and manganese**<br>Secondary MCL<br>Iron = 300<br>Manganese = 50 | µg/L | **Iron**<br>ND to 260<br>(240 for desalter wells)<br>**Manganese**<br>ND to 92<br>(310 for desalter wells) | Iron and manganese are reported for East Valley Wells and for Desalter Wells 75 and 76 |

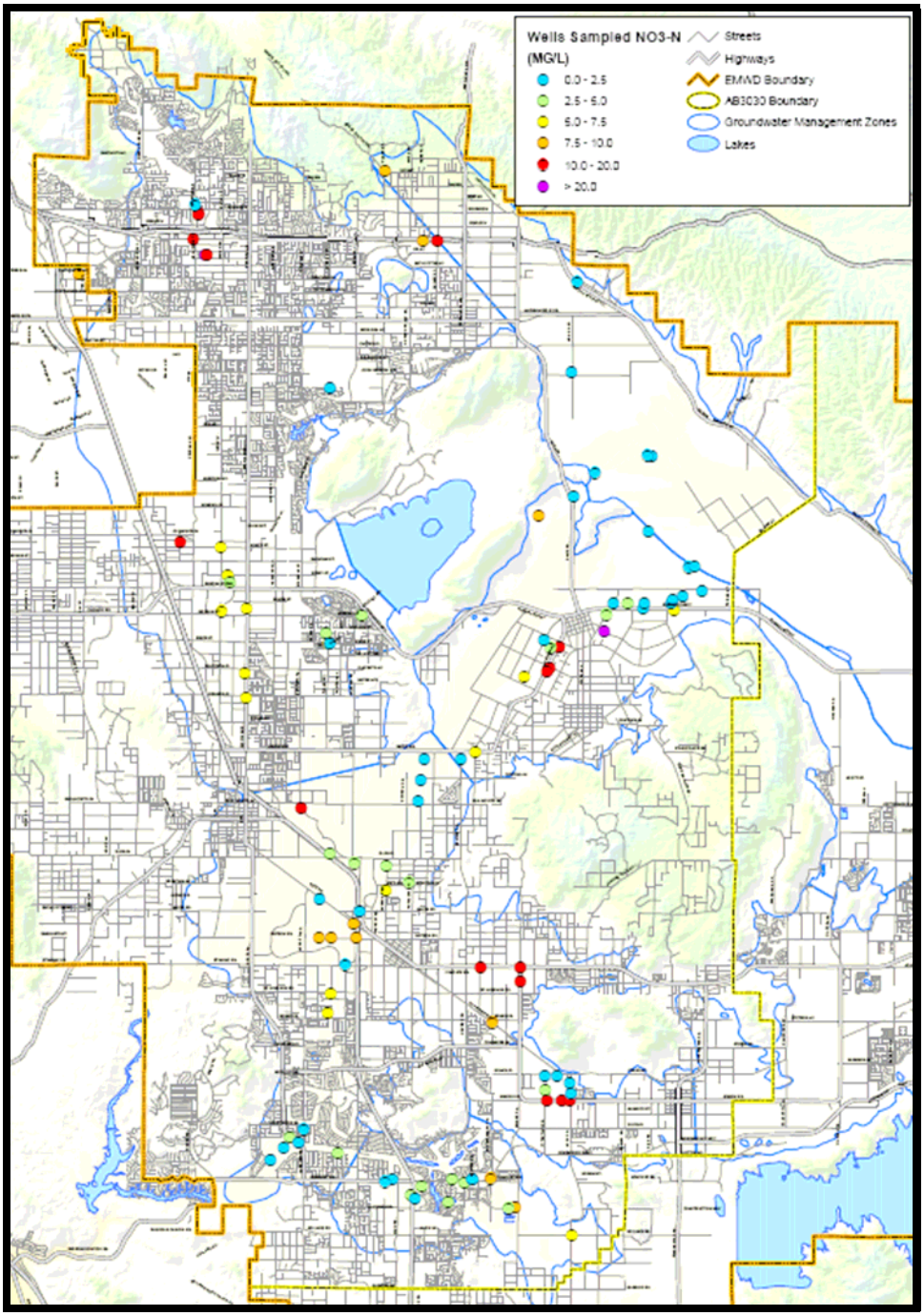
Source: Eastern MWD, 2004, 2005, 2006b

**Figure 17-6**
**Summary of TDS Concentrations (2005)**




Eastern MWD, 2006a

**Figure 17-7**
**Summary of Nitrate Concentrations (2005)**




Eastern MWD, 2006a

Since the opening of March Air Force Base in 1918, in the Perris North subbasin, various aircraft operations used cleaning solvents, petroleum products, and other hazardous substances. For more than eight decades, these contaminants were spilled, disposed of onto the ground, or stored in underground tanks that subsequently leaked. As a result, soil and groundwater have been contaminated by a variety of chemicals. The cleanup activity or remedial action is in accordance with an agreement signed by the Air Force and the three regulatory agencies overseeing environmental cleanup at March (U.S. Environmental Protection Agency, California E.P.A. Department of Toxic Substances Control, and California Regional Water Quality Control Board). As part of the cleanup effort, March Air Reserve Base operates monitoring, extraction, and injection wells. (Eastern MWD, 2006a)

Historical agricultural use and naturally occurring conditions in the Menifee and Perris South subbasins have contributed to high TDS groundwater in these areas.

Groundwater production has decreased in some areas due to conversion of agricultural lands to residential uses and high TDS in groundwater. The reduced production has resulted in rising groundwater levels. Rising groundwater can leach salts from the soil into the groundwater, and create areas of higher TDS levels or brackish groundwater. (Eastern MWD, 2006a)

**Blending Needs**

Groundwater production from a few wells is blended with imported water to meet drinking water quality regulations. Blending provided by Eastern MWD (2006a) is summarized in **Table 17-5**.

**Groundwater Treatment**

As discussed above, the Menifee and Perris Desalters treat up to 3,400 AFY of groundwater from the Menifee and Perris South subbasins and March Air Reserve Base operates treatment systems for the cleanup of VOCs, petroleum hydrocarbons and other hazardous substances. Approximately 1,441 AF was treated by the Menifee Desalter in 2004. The Perris I and Perris II desalters were not yet online during the period of record for this report.

**Table 17-6** summarizes the cost to treat the high TDS water recovered from the 8 currently operating wells (Eastern MWD, 2006a).

**Table 17-5**
**Blending Needs in the West San Jacinto Basins**

| Constituent Blended | Average Annual Blended (AFY) |
|---|---|
| Nitrate | 900 |
| TDS | 1,400 |

**Table 17-6**
**Summary of Groundwater Treatment in the West San Jacinto Basins**

| Treatment Type | Number of Wells | Constituents(s) of Concern | Treatment Target | Treatment Cost ($/AF) | Amount Treated (AFY) |
|---|---|---|---|---|---|
| Reverse Osmosis | 8 | TDS | 500 mg/L | $503.50 | 3,400 |

## CURRENT GROUNDWATER STORAGE PROGRAMS

No formal groundwater storage programs have been reported in the West San Jacinto Basins.

## BASIN MANAGEMENT CONSIDERATIONS

Considerations for the West San Jacinto Basins include:

- There are no legal constraints, limitations, or ongoing/potential legal disputes within the West San Jacinto Management Area.

- The primary constraint on groundwater extraction is poor water quality, which limits use of groundwater as a potable water resource. Another related limiting factor involves controlling the migration of poor quality water into areas of pumped good quality groundwater.

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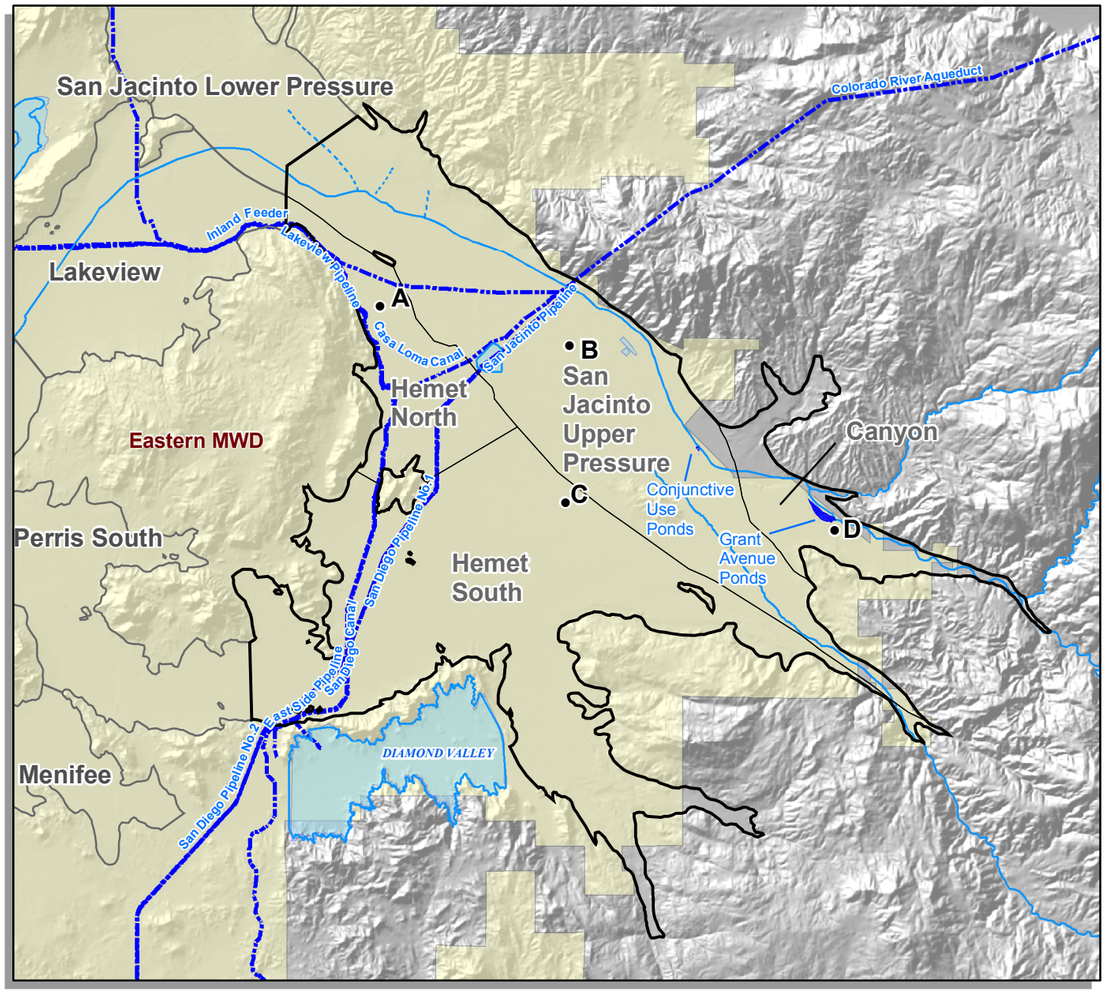


## Hemet/San Jacinto Basins

A ● Key Well
Recharge Basins
Freeways (TBM)
River
Water Body
Santa Ana Regional Interceptor Line
MWD Pipeline
Adjacent Basin
Basin
MWD Member Agency Boundary (color varies)

Note: This map was prepared by the Metropolitan Water District of Southern California for its own use. No warranty is expressed or implied as to the correctness, timeliness, or content of the information shown herein.

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Additional Data Sourse(s): Santa Ana Watershed Project Authority (SAWPA); California Spatial Information Library (CaSIL).

N W E S

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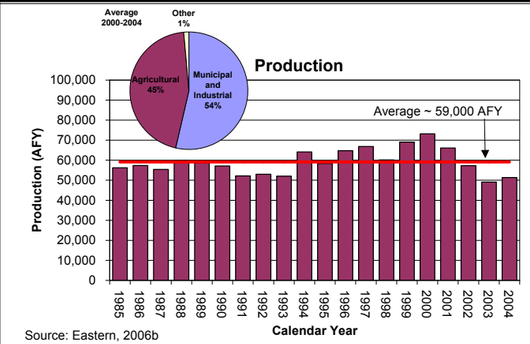
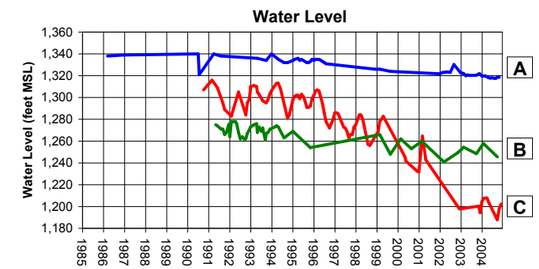
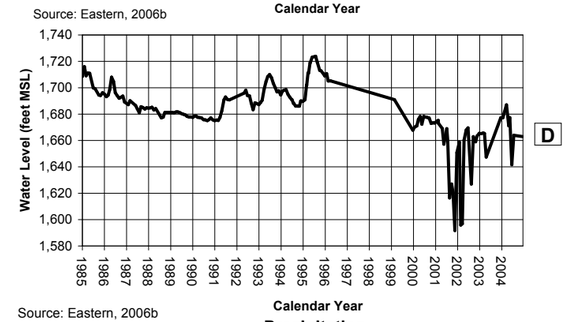


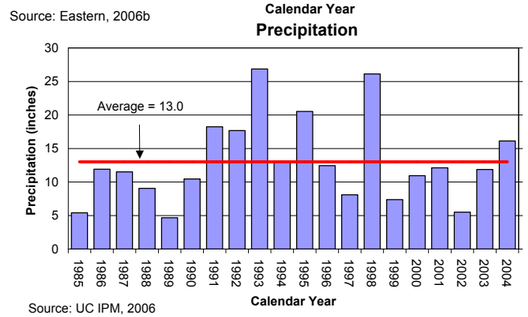

Source: Eastern, 2006b



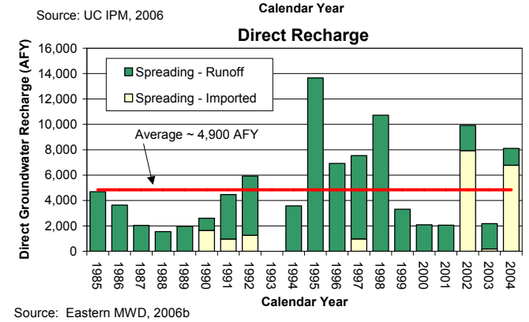

Source: Eastern, 2006b




Source: Eastern, 2006b




Source: UC IPM, 2006




Source: Eastern MWD, 2006b

## BASIN FACTS

### Hemet-San Jacinto Basins

**Description**
**Location:** Riverside County
**Watershed Surface Area:** 88 square miles
**Subbasins:**
San Jacinto Upper Pressure
Canyon
Hemet North
Hemet South
**Management:** Adjudicated. Amended adjudication in process Canyon subbasin adjudicated by 1954 Fruitvale Judgment. Basin is currently managed by Eastern MWD. Formal Groundwater Management Plan in process.
**MWD Member Agencies:**
Eastern MWD

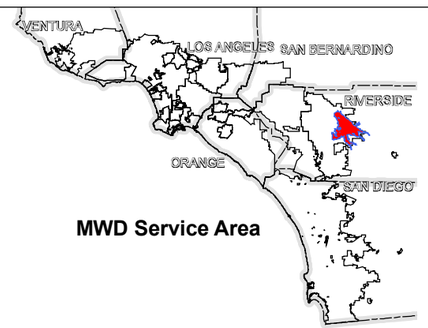
| | Hemet-San Jacinto |
|---|---|
| **Natural Safe Yield** | Unknown |
| **Operational Safe Yield** | 40,000 to 50,000 AFY |
| **Total Storage** | ~1.3 million AF |
| **Unused Storage Space** | 950,000 AF |
| **Portion of Unused Storage Space Available for Storage** | 400,000 AF |

**Storage and Extraction Facilities**

| | Hemet-San Jacinto |
|---|---|
| **Production Wells** | |
| Production Capacity | 121,500 AFY |
| Average 1985-2004 | 59,000 AFY |
| **Injection Wells** | |
| Injection Capacity | None |
| Average 1985-2004 | None |
| **Spreading Basins** | |
| Spreading Capacity | ~19,400 AFY |
| Average 1985-2004 | 4,900 AFY |

**Basin Management Considerations**

- Tribal Settlement with Soboba Tribe limits extractions
- Declining water levels and overdraft could limit future extraction potential
- Water quality, particularly TDS and nitrate, could limit future storage and extraction potential




MWD Service Area

**Plate 18-1**
**Overview of Hemet-San Jacinto Basins**

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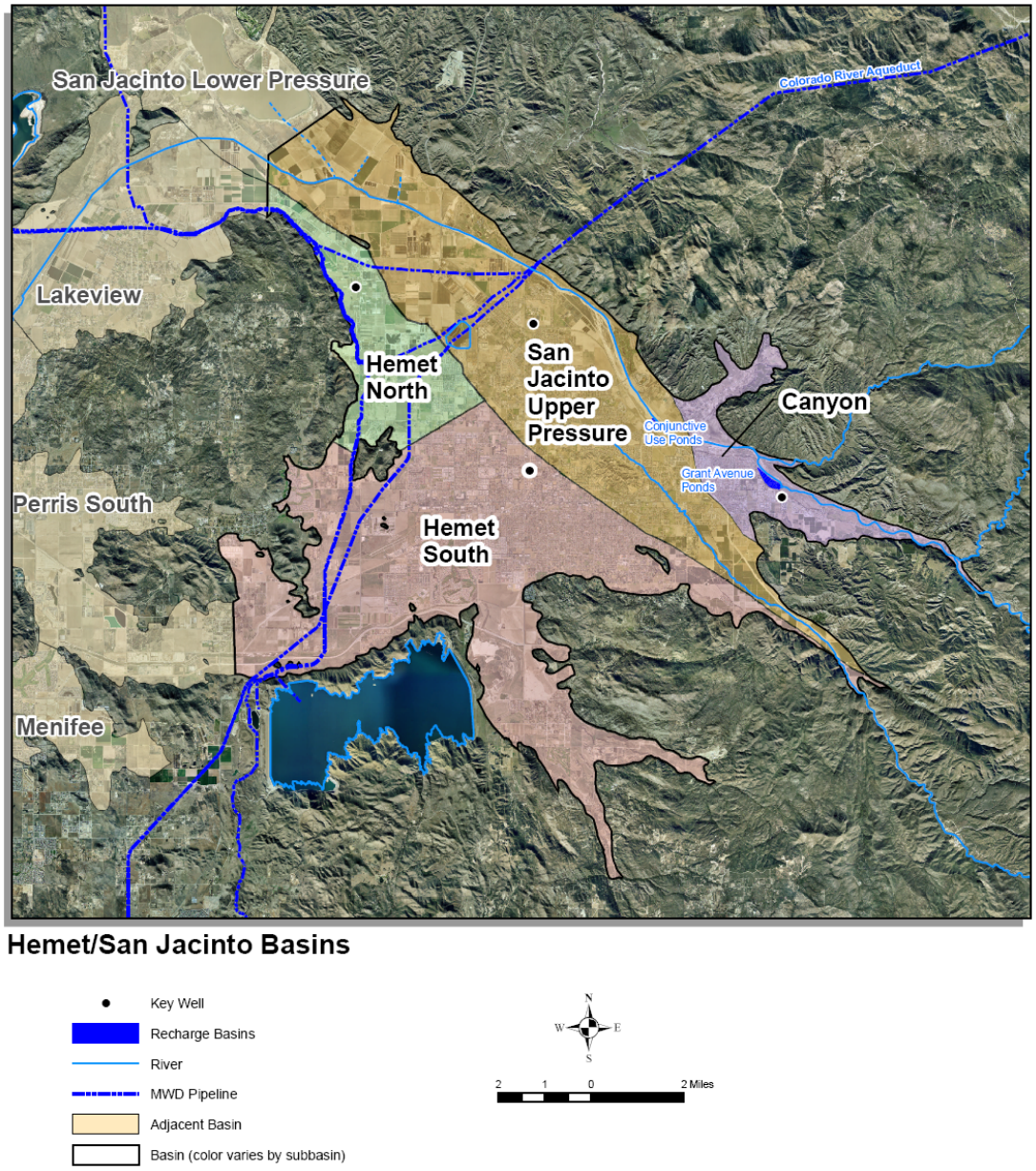
The Hemet-San Jacinto Basins are located within the San Jacinto River Watershed in Western Riverside County. The Hemet-San Jacinto Basins consist of the Hemet South, Hemet North, Canyon, and San Jacinto Upper Pressure subbasins or management zones. These subbasins underlie Eastern Municipal Water District's (Eastern MWD) service area and are utilized for groundwater supply for the cities of San Jacinto and Hemet, as well as unincorporated areas of Riverside County. The location and key facilities of the Hemet-San Jacinto Basins are shown in **Figure 18-1**.

**Figure 18-1**
**Map of the Hemet-San Jacinto Basins**



## BASIN CHARACTERIZATION

The following section provides a physical description of the Hemet-San Jacinto Basins including geographic setting and hydrogeologic characteristics. A summary of the hydrogeologic properties of the Hemet-San Jacinto Basins is provided in **Table 18-1**.

### Basin Producing Zones and Storage Capacity

The Hemet-San Jacinto Basins comprise alluvial-filled valleys that are surrounded and underlain, for the most part, by impermeable granitic and metamorphic bedrock or are contained by barrier fault zones. In some locations, groundwater flow between these basins is also constrained by groundwater divides and internal flow systems.

The depth of the groundwater basins ranges from 40 feet to 8,000 feet below the ground surface (Eastern MWD, 2006b). The deepest subbasin is the San Jacinto Upper Pressure, which was formed by tectonic offsets along the active San Jacinto fault (Claremont branch) and the Casa Loma fault causing a down-dropped graben between the two faults. The total depth of fresh water within the San Jacinto Upper Pressure subbasin has not been precisely determined (WRIME, 2003).

In the southeastern portion of the San Jacinto Upper Pressure subbasin and in the Canyon subbasin, sands and gravels dominate; which allows for rapid recharge and generally unconfined groundwater conditions. To the northwest, the basin becomes finer-grained and the unnamed deeper aquifers are confined (WRIME, 2003).

The specific yields and water levels within the basins are used to estimate the Hemet-San Jacinto Basins' storage capacity. Total storage in the basin is estimated to be approximately 1.3 million AF. While the basins are estimated to have an additional combined storage capacity available of about 950,000 AF, only about 400,000 AF are estimated as useable (Eastern MWD, 2006b).

### Safe Yield/Long-Term Balance of Recharge and Discharge

The primary sources of natural groundwater recharge are from precipitation infiltration and percolation of flows on the San Jacinto River and its tributaries as they cross the area during periods of heavy rainfall. Because heavy rainfalls are infrequent, natural recharge is limited (Eastern MWD, 2000). **Figure 18-2** provides historical precipitation data from the Hemet Station for the Hemet-San Jacinto Basins (UC IPM, 2006). The 20-year average precipitation for this area between 1985 and 2004 was approximately 13 inches.

The operational yield, which is the long-term withdrawal from the groundwater system not exceeding natural and artificial recharge, has been estimated to be between 40,000 AFY and 50,000 AFY for a recent normal year range (EVMWD, 2006e). Currently, the average operational yield is estimated at 45,000 AFY, which includes in the estimate up to 8,000 AFY of imported recharge water (Eastern MWD, 2005b; Eastern MWD, 2006b).

**Table 18-1**
**Summary of Hydrogeologic Parameters of the Hemet-San Jacinto Basins**

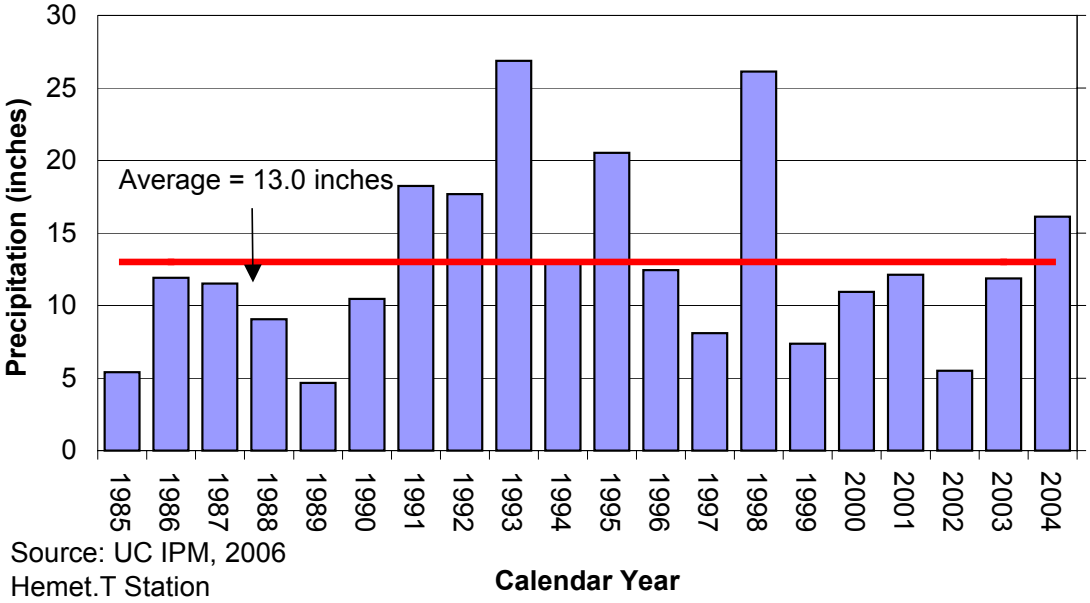
| Parameter | Description |
|---|---|
| **Structure** | |
| Aquifer(s) | Forebay areas (unconfined)<br>• Canyon<br>• Southeast portion Upper Pressure<br>• South Hemet<br>Pressure areas (semi-confined to confined)<br>• Northwest portion Upper Pressure<br>• North Hemet |
| Depth of groundwater basin | 40 to 8,000 feet |
| Depth of producing zones or screen intervals | Canyon: 150 to 1,000 feet<br>Upper Pressure: 400 to 1,000 feet<br>Hemet North and South: 150 to 400 feet |
| **Yield and Storage** | |
| Natural Safe Yield | Unknown |
| Operational Safe Yield | 40,000 to 50,000 AFY<br>Average: 45,000 AFY |
| Total Storage | ~1.3 million AF |
| Unused Storage Space | 950,000 AF |
| Portion of Unused Storage Space Available for Storage | 400,000 AF |

Source: WRIME, 2003; Eastern MWD, 2006a; Eastern MWD, 2006b; Eastern MWD, 2006e; DWR, 2006

Groundwater production in the Hemet-San Jacinto Basins has exceeded the operational yield for several years, and the basins are currently in a state of overdraft. Estimated overdraft is approximately 600 AFY in the Canyon subbasin, 10,000 AFY in the Upper Pressure subbasin and 3,000 AFY in the Hemet South subbasin. Production in the Hemet North subbasin has generally been in balance with this subbasin's long-term operational safe yield. On average, groundwater storage in all the Hemet-San Jacinto Basins has been reduced about 14,000 AFY due to overdraft for the period from 1958 to 2001 (WRIME, 2003). Current estimates of overdraft are approximately 10,000 AFY (Eastern MWD, 2005a; Eastern MWD, 2006e). Projections of water supply show the need for an additional 15,000 AFY to accommodate future

growth (Eastern MWD, 2006b). Confined aquifers in the Hemet-San Jacinto Basins, particularly in the northern portion of the San Jacinto Upper Pressure subbasin are susceptible to subsidence.

**Figure 18-2**
**Historical Precipitation in the Hemet-San Jacinto Basin**




Source: UC IPM, 2006
Hemet.T Station

## GROUNDWATER MANAGEMENT

The following section describes how the Hemet-San Jacinto Basins are managed. The summary includes a discussion of the governing structure and legal agreements with adjoining basins.

### Basin Governance

The Hemet-San Jacinto Basins are currently managed by Eastern MWD and the Canyon subbasin is adjudicated. In addition, as discussed below, an adjudication for all basins is currently in process. The governing agencies in the Hemet-San Jacinto Basins are listed in **Table 18-2**.

Eastern MWD's groundwater production in the Canyon and San Jacinto Upper Pressure subbasins has been historically limited by the 1954 Fruitvale Judgment and Decree (Judgment). The Judgment limits Eastern MWD's groundwater extraction from the Canyon subbasin to 4,500 AFY when the depth to water in a specified Fruitvale well is greater than 25 feet and restricts exporting pumped water outside the Upper and Canyon subbasins to 12,000 AFY. Other groundwater producers in the two subbasins are not restricted.

To further protect the groundwater resources within the Hemet-San Jacinto Basins, Eastern MWD, in cooperation with Lake Hemet Municipal Water District, the cities of Hemet and

San Jacinto and private groundwater producers, agreed upon the Principles of Groundwater Management in 2004 following mutual agreement on Interim Principles in 2003 (Eastern 2005b). This plan is currently in the process of being incorporated as part of the Stipulated Judgment by the courts and will supersede the Fruitvale Judgment and Decree. Key elements of the plan call for (1) reducing public agency groundwater production, (2) implementing the San Jacinto River Recharge and Recovery Project, (3) groundwater replenishment, (4) in-lieu water use, (5) additional water conservation measures, and 6) water monitoring. Prior to implementing these elements, though, a supplemental environmental impact report (EIR) must be completed and approved. The process for this EIR is currently being pursued by Eastern MWD (Eastern MWD, 2006c).

**Table 18-2**
**Summary of Management Agencies in the Hemet-San Jacinto Basins**

| Agency | Role |
|---|---|
| Eastern MWD | Member of Watermaster Board.<br>Retail and wholesale water sales.<br>Groundwater producer.<br>Operation of wastewater treatment, recycled water and spreading facilities.<br>Financial participant in purchase of replenishment water. |
| Lake Hemet Municipal Water District (Lake Hemet MWD) | Members of Watermaster Board.<br>Retail water sales.<br>Groundwater producers.<br>Financial participants in purchase of replenishment water. |
| City of Hemet | |
| City of San Jacinto | |

The final Hemet-San Jacinto Water Management Plan will resolve a number of issues that have involved groundwater within the Hemet-San Jacinto Basins including settlement of the suit by the Soboba Band of Luiseno Indians regarding groundwater flow into Metropolitan's San Jacinto Tunnel along the Colorado River Aqueduct. The plan also addresses the pumping overdraft and declining water levels, ensures water supply reliability, provides for urban growth, protects and enhances water quality, provides for water supply and water quality monitoring, and would develop a cost-effective water supply.

Under the Hemet-San Jacinto Water Management Plan, groundwater resources would be managed by a five-member Watermaster Board with a representative from each of the four agencies listed above and a representative from the private groundwater producers.

Under this new management structure, each public agency would be required to achieve a 10 percent reduction from each of their base production rights in the first year after entry into the Stipulated Judgment, and periodic adjustments as necessary to achieve the operational safe yield (Eastern MWD, 2006b).

### Interactions with Adjoining Basins

Flows from the Upper Pressure subbasin into the Lakeview subbasin, between Hemet and Lakeview subbasins, and the Hemet and the Perris South areas are dependant on groundwater gradients and points of connection are restricted both laterally and vertically. Therefore, large exchanges of groundwater flow between subbasins are not likely. Formal agreements have not been established regarding such underflow between these subbasins (WRIME, 2003, Eastern MWD, 2006b).

## WATER SUPPLY FACILITIES AND OPERATIONS

The following section describes the water supply facilities within the Hemet-San Jacinto Basins. Facilities include approximately 147 production wells and over 50 acres of spreading basins.

### Active Production Wells

Eastern MWD's extraction monitoring program began in 2004 consisting of metering or estimating production from wells included in the program. As shown in **Table 18-3**, extraction from the Hemet-San Jacinto Basins occurs from a total of 49 municipal wells and 98 or more private wells (182 total wells were monitored for the program in 2004 and 174 wells in 2005; Eastern MWD, 2006a). Over the 20-year period from 1985 to 2004, average production has been about 59,000 AFY with approximately 54 percent of this production for municipal purposes. For the fiscal year 2003/04 period, approximately 64 percent of the production was from municipal wells, while the remaining 36 percent of production was for agricultural and other water uses indicating the increase in demand for municipal production as urban areas in the region continue to grow. Nearly 100 percent of the private wells are for agriculture. The few private domestic wells serve the Soboba Tribe. **Table 18-3** provides a breakdown of water supply by category.

**Table 18-3** also provides a summary of the costs for production wells belonging to Eastern MWD, not including other agencies cost (such as Lake Hemet MWD or the Cities of Hemet and San Jacinto). Total production costs are approximately $100 per AF. **Figure 18-3** shows historical production in the Hemet-San Jacinto Basin.

### Other Production

As summarized above, groundwater production in the Hemet-San Jacinto Basins is from private agriculture and municipal wells with only a few private domestic wells that serve the Soboba Tribe (Eastern MWD, 2006a).

**ASR Wells**

There are no ASR wells in the Hemet-San Jacinto Basins.

**Table 18-3**
**Summary of Production Wells in the Hemet-San Jacinto Basin**

| Category | Number of Wells | Estimated Production Capacity (AFY) [1] | Average Production 1985-2004 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| Municipal and Industrial | 49 | 58,000 | 31,751 | $99.58 includes power, disinfection and O&M |
| Agricultural | 98+ | 61,000 | 26,493 | Data not available |
| Other | | 2,500 | 866 | |
| **Total** | **147+** | **121,500** | **59,110** | **--** |

Source: Eastern MWD, 2006
1. Production capacity based upon maximum monthly production for past 5 years

**Spreading Basins**

Spreading basins are located in two areas of the Hemet-San Jacinto Basins: (1) three acres of Conjunctive Use Ponds in the San Jacinto Upper Pressure subbasin that receives imported State water, and (2) approximately 50 acres of Ponds along Grant Avenue in the Canyon subbasin that receives both imported State water and diverted San Jacinto River runoff. **Table 18-4** summarizes basin sizes, estimated capacities, source of the water used for recharge and the basin owner. These basins are shown on **Figure 18-1**.

Recharge of runoff water is not measured other than San Jacinto River Diversions (shown below in **Figure 18-4**), which are recharged in ponds in the Canyon subbasin. Eastern MWD is restricted by permit to diverting no more than 5,760 AFY from the San Jacinto River while Lake Hemet MWD's diversions from the river are unlimited. Lake Hemet MWD typically spreads a portion of their river diversions for groundwater recharge. It should be noted that recharge only occurs in years when there is sufficient flow in the San Jacinto River, which does not flow every year (Eastern MWD, 2006b). **Figure 18-4** shows the volume of water recharged in the Hemet-San Jacinto Basins as a result of spreading imported and diverted river runoff water sources. An average of about 4,900 AFY has been recharged in these spreading basins. Recycled water storage ponds also contribute incidental recharge to the basins although the amount is not estimated.

**Figure 18-3**
**Historical Groundwater Production in the Hemet-San Jacinto Basin**

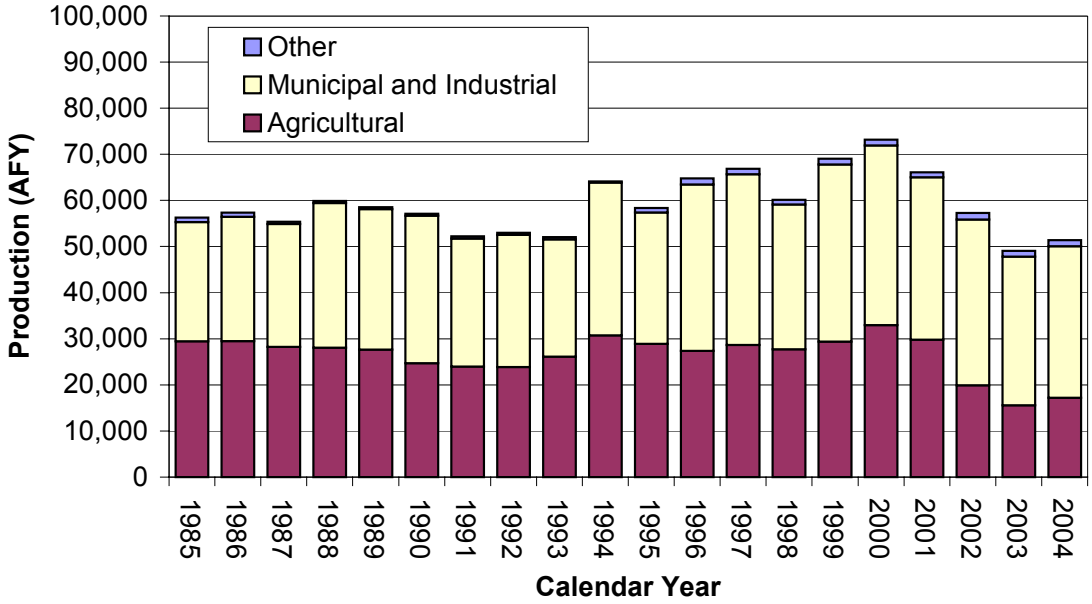



**Table 18-4**
**Summary of Spreading Basins in the Hemet-San Jacinto Basins**

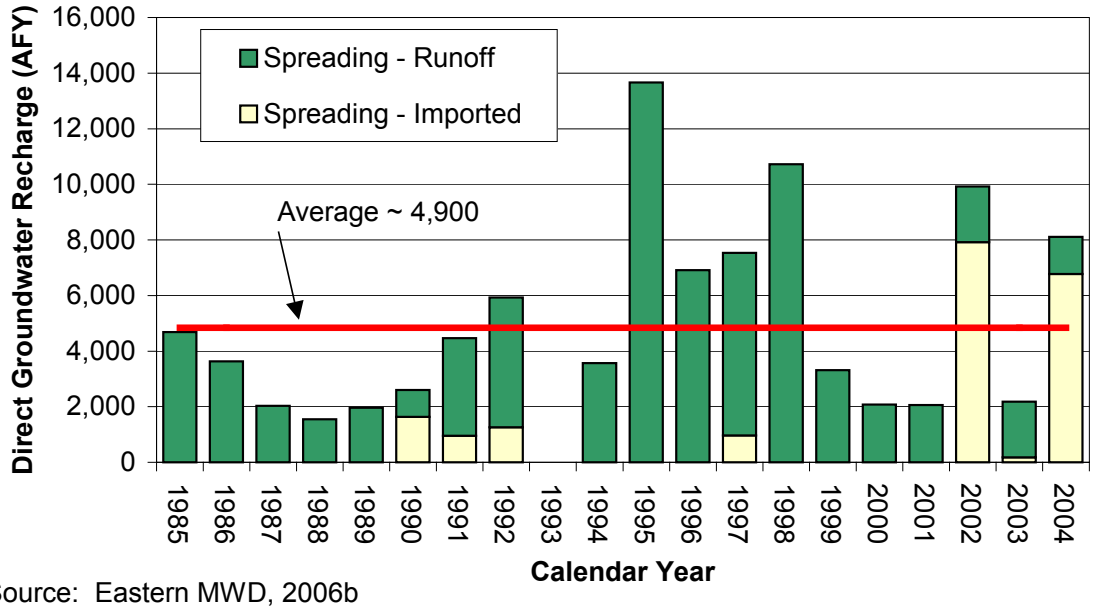
| Basin | Area (acres) | Recharge Capacity (cfs) | Recharge Capacity (AFY) | Source Water | Owner |
|---|---|---|---|---|---|
| Conjunctive Use Ponds San Jacinto Upper Pressure Basin | 3 | 10.2 [1] | 7,380 | Imported | Eastern MWD |
| Grant Avenue Ponds Canyon Basin | 28 | 8.6 [1] | 6,240 | Imported and/or Runoff | Eastern MWD |
| Grant Avenue Ponds Canyon Basin | 22 | Data not available | 5,760 [2] | Runoff | Eastern MWD |
| Total | 53 | -- | 19,380 | -- | -- |

Source: Eastern MWD, 2006b

1. Figures are based on January 2006 actual recharge. More water could be recharged, but pipe capacity limits current recharge ability.

2. Eastern's permit for diversion of streamflow is limited to 5,760 AF per year. Diversions can only occur when the river is flowing and, consequently, no diversion or less than maximum diversion frequently occurs. Lake Hemet MWD also diverts streamflow from the San Jacinto River for recharge and other beneficial uses.

**Figure 18-4**
**Historical Groundwater Recharge in the Hemet-San Jacinto Basins**




Source: Eastern MWD, 2006b

**Seawater Intrusion Barriers**

There are no seawater intrusion barriers in the Hemet-San Jacinto Basins.

**Desalters**

There are no desalters in the Hemet-San Jacinto Basins.

## GROUNDWATER LEVELS

As part of Eastern MWD's groundwater monitoring program, static water levels are measured twice a year, once in the spring following the winter rains and in the fall during the dry season. In 2005, water levels in 183 wells were measured in the spring and in 179 wells in the fall. A groundwater contour map for this time period is provided in **Figure 18-5**. Within the Hemet-San Jacinto Basins, groundwater flow is generally from the southeast to the northwest (WRIME, 2003). The depth to groundwater in the basins ranges between 21 to 634 feet. In some areas in the Canyon subbasin, cienegas are present as a result of the barrier created by faulting.

**Figure 18-6** shows historical groundwater levels for several wells within the Hemet-San Jacinto Basins. The hydrographs show groundwater levels have been steadily declining in the Hemet-San Jacinto Basins. For example, water levels have declined as much as 100 feet in the Upper Pressure area since 1990. Water level declines in the Hemet North area are less dramatic

with declines of only about 20 feet over the past 20 years. As discussed above, subsidence is an issue in the areas where groundwater is confined and declines continue.

**Figure 18-5**
**Groundwater Contour Map for the Hemet-San Jacinto Basins– Spring 2005**

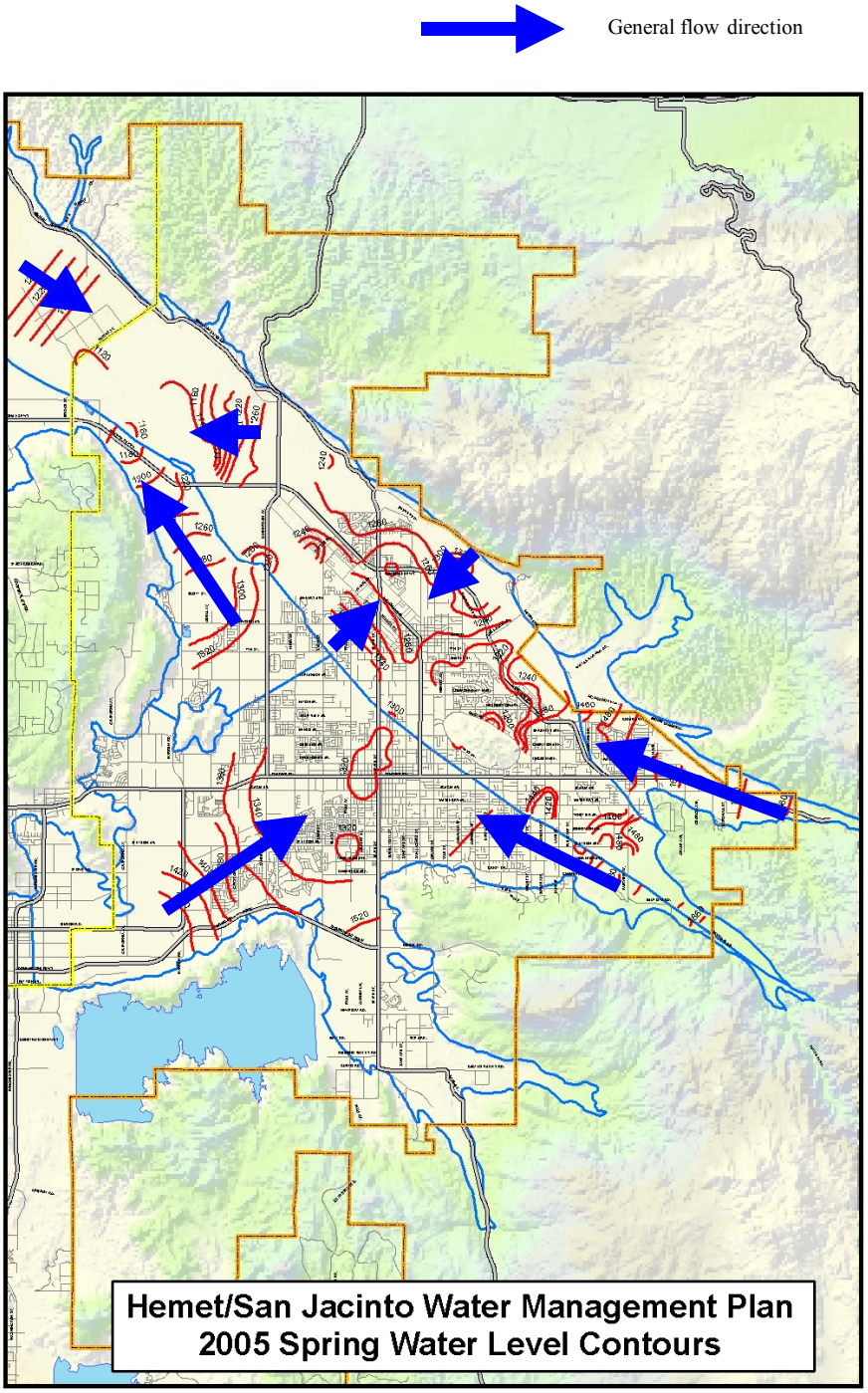
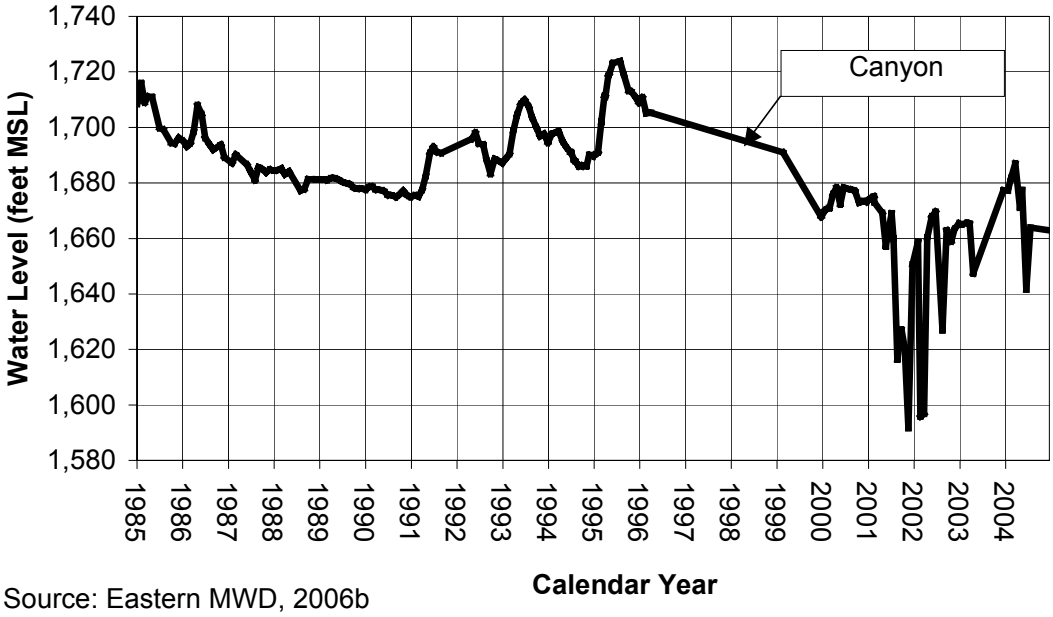
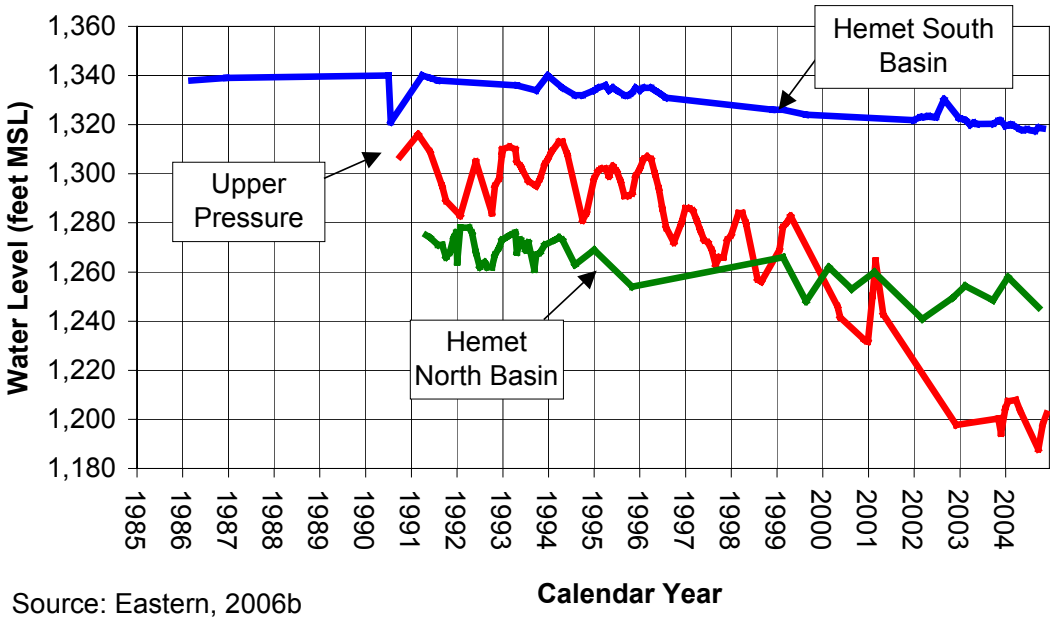


**Figure 18-6**
**Historical Water Levels in the Hemet-San Jacinto Basins**




Source: Eastern MWD, 2006b




Source: Eastern, 2006b

## GROUNDWATER QUALITY

The following provides a brief description of the groundwater quality issues in the Hemet-San Jacinto Basins.

**Groundwater Quality Monitoring**

The Hemet-San Jacinto Groundwater Monitoring Program, a cooperative effort funded by Eastern MWD, Lake Hemet MWD, and the cities of Hemet and San Jacinto, was initiated in 2004 to collect, compile, and analyze water level data, water quality data, and extraction data. The program also documents other pertinent information regarding activities in the Hemet-San Jacinto Water Management Plan area such as issued well permits, capping and sealing of inactive wells, rainfall, surface water flows, conjunctive use/groundwater recharge, recycled water, and groundwater storage (Eastern MWD, 2006a).

The collected data are compiled and entered monthly into Eastern MWD's Regional Water Resources Database. Along with Eastern MWD, Lake Hemet MWD and the cities provide data on their wells, provide pro rata shares of the cost, and assist in communicating with the private well owners in their respective jurisdictions (Eastern MWD, 2006a).

Eastern MWD, Lake Hemet MWD and the cities of Hemet and San Jacinto collected 115 groundwater quality samples in 2005 for the annual water quality monitoring. Samples were collected from available private agricultural and domestic supply wells and municipal supply wells. Constituents tested included general minerals, metals, alkalinity, nitrogen compounds and miscellaneous water quality parameters such as pH, temperature, total dissolved solids (TDS) and total organic carbon (Eastern MWD, 2006a).

**Groundwater Contaminants**

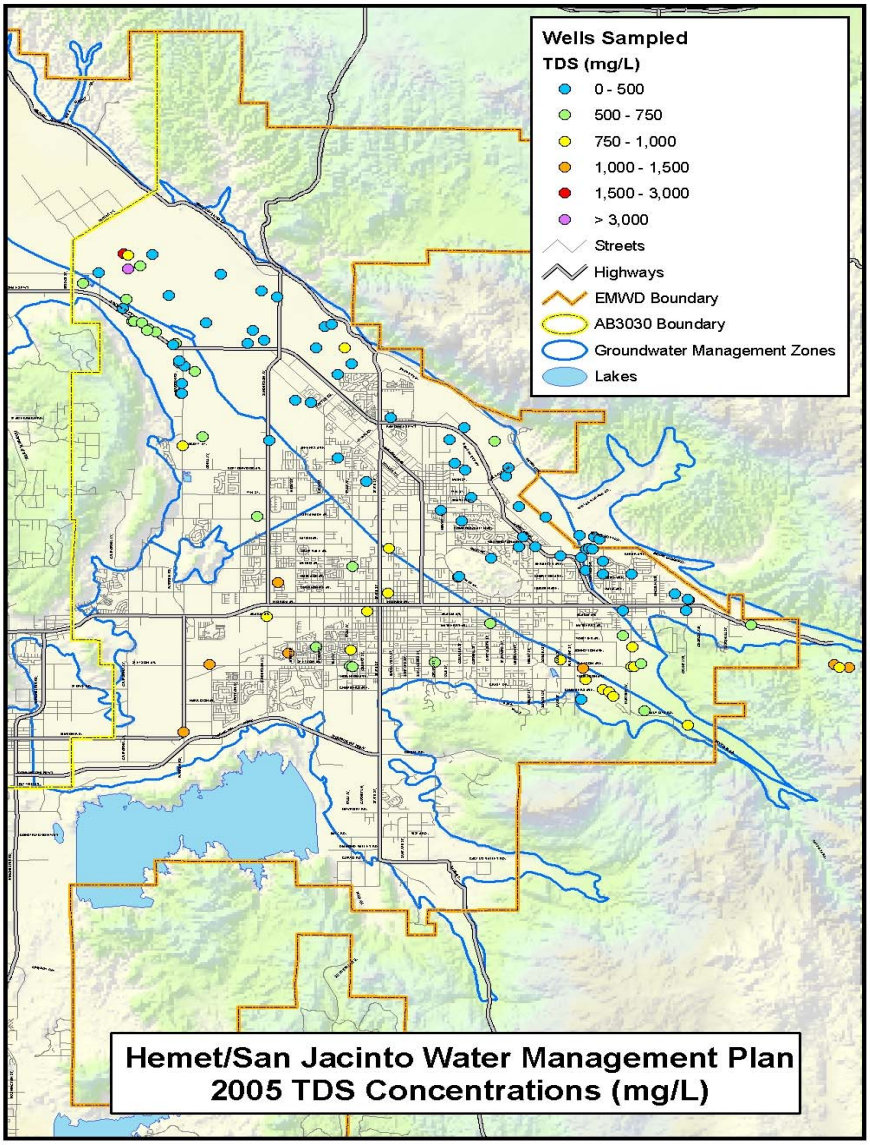
Constituents of concern for the Hemet-San Jacinto Basins include: TDS, nitrate, hydrogen sulfide, iron and manganese. A description of the range and extent for each constituent as well as constituents of regional concern (volatile organic compounds and perchlorate) are summarized in **Table 18-5**.

Results of the monitoring identified the best quality water in the canyons and along the San Jacinto River within the Canyon subbasin as indicated by the TDS concentrations for wells shown on **Figure 18-7**. Significant municipal production occurs in this area of the Canyon subbasin (Eastern MWD, 2006a).

As shown in **Figure 18-8**, nitrate concentrations in the basin show a similar trend to TDS with the best quality water occurring along the San Jacinto River of the Canyon subbasin. Nitrate concentrations in samples that exceed the MCL of 10 mg/L for nitrate as nitrogen are mostly from wells located in the southern and western portions of the Hemet-San Jacinto Basins. The range in TDS and nitrate concentrations reported from the annual water quality-monitoring program for 2005 for each subbasin are shown in **Table 18-5** (Eastern MWD, 2006a).

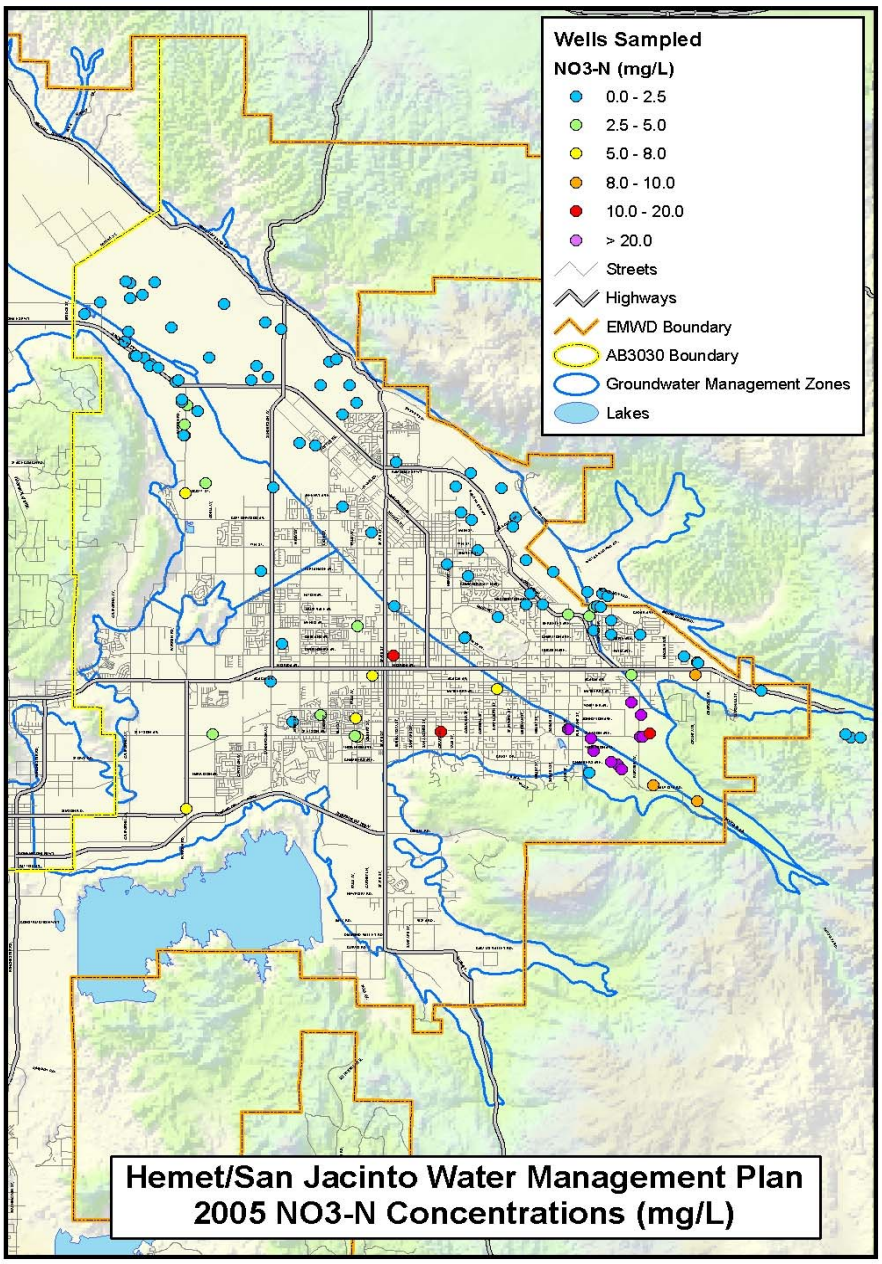
Iron and manganese data, also summarized in **Table 18-5**, were provided by Eastern (2006b) for the Upper Pressure subbasin.

**Figure 18-7**
**Summary of TDS Concentrations (2005)**




Eastern MWD, 2006b

**Figure 18-8**
**Summary of Nitrate Concentrations (2005)**




Eastern MWD, 2006b

**Table 18-5**
**Summary of Constituents of Concern in the Hemet-San Jacinto Basins**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br><br>Secondary MCL = 500 | mg/L | Canyon: 190 to 1,330<br>Upper Pressure: 180 to 3,050<br>Hemet North.: 360 to 1,000<br>Hemet South: 230 to 1,340 | Values reported are summarized from the 2005 Water Quality Monitoring Program for 115 wells |
| **Nitrate (as N)**<br>MCL = 10 | mg/L | Canyon: <0.1 to 10<br>Upper Pressure: <0.1 to 32<br>Hemet North.: <0.1 to 6.1<br>Hemet South: 0.6 to 31 | Values reported are summarized from the 2005 Water Quality Monitoring Program for 115 wells |
| **VOCs**<br>**(TCE and PCE)**<br>TCE MCL = 5<br>PCE MCL = 5 | µg/L | ND | TCE and PCE are not known to be detected in the Hemet-San Jacinto basins. |
| **Perchlorate**<br><br>Notification level =6 | µg/L | ND to 6 | Two wells have known detections of perchlorate. Concentrations are at or below the notification level. |
| **Hydrogen sulfide**<br><br>No MCL | µg/L | Data not available | 1 well has been impacted by hydrogen sulfide |
| **Iron and manganese**<br><br>Iron Secondary MCL = 300<br>Manganese Secondary MCL = 50 | µg/L | Iron: <4 to 140,000<br>Manganese: <1.0 to 4,600 | Iron and manganese are only reported for the Upper Pressure subbasin. Of the 50 reported results for 2005, 19 exceeded the iron secondary MCL of 300 ug/L and 30 exceeded the manganese secondary MCL of 50 ug/L |

Source: Eastern MWD, 2006b, Regional Board, 2006

Two wells have known detections of perchlorate (Regional Board, 2006). Concentrations are at or below the notification level. The VOCs trichloroethylene (TCE) and tetrachloroethylene (PCE) are not known to be detected in the Hemet-San Jacinto basins.

**Blending Needs**

Data related to blending needs are not available at this time.

### Groundwater Treatment

One well in the Hemet-San Jacinto Basins owned by Eastern MWD has hydrogen sulfide gas and high iron and manganese and is treated with wellhead treatment as summarized in **Table 18-6** (Eastern MWD, 2006b).

**Table 18-6**
**Summary of Groundwater Treatment in the Hemet-San Jacinto Basins**

| Treatment Type | Number of Wells | Constituents(s) of Concern | Treatment Target | Treatment Cost ($/AF) | Amount Treated (AFY) |
|---|---|---|---|---|---|
| Proprietary "Electra Media" with chlorine as an oxidizer | 1 | Hydrogen sulfide, iron and manganese | ND | Data not available | 10,000 |

Source: Eastern MWD, 2006

Wellhead treatment, if any, by other agencies (such as Lake Hemet MWD or the Cities of Hemet and San Jacinto) is not currently known (Eastern MWD, 2006b).

## CURRENT GROUNDWATER STORAGE PROGRAMS

As a Metropolitan member agency, Eastern MWD imports both State Project water and Colorado River Aqueduct water into the Hemet-San Jacinto Basins area. Imported untreated State water is currently received through Eastern's EM-14 service connection for groundwater recharge in the San Jacinto area.

Currently, Eastern MWD is pursuing efforts to work with other agencies and private groundwater producers to establish cooperative groundwater management programs including groundwater storage and conjunctive use programs (Eastern MWD, 2000). Preparation is underway to implement the Hemet-San Jacinto Recharge and Recovery Program. This project will involve 100 acres of ponds, eight recovery wells, and a 60-inch diameter pipeline from Eastern MWD's EM-14 connection to the ponds. The objectives of the project include: providing Tribal Settlement Water (long-term average of 7,500 AFY), elimination of groundwater overdraft (10,000 AFY) and additional long-term supply (15,000 AFY).

## BASIN MANAGEMENT CONSIDERATIONS

The primary considerations in groundwater management of the Hemet-San Jacinto Basins are:

- The 1954 Fruitvale Judgment and Decree limits production from the Canyon subbasin to 12,000 AFY in normal precipitation years when the water level in a key well is not more than 25 feet below a specific elevation. If the groundwater levels in the key well are more than 25 feet below the specific elevation, then production limits from the Canyon subbasin drop to 4,500 AFY.

- The settlement of the suit by the Soboba Band of Luiseno Indians regarding groundwater flow into Metropolitan's San Jacinto Tunnel along the Colorado River Aqueduct requires supplying the Tribe with a long-term average of 7,500 AFY.

- Water quality issues (TDS, nitrate, hydrogen sulfide, iron and manganese) could limit ability to store and extract water.

- Recharge pipeline capacities and adjudication of the San Jacinto River limit the ability to recharge additional imported water or runoff, respectively.

- Confined aquifers in the Hemet-San Jacinto Basins, particularly in the northern portion of the San Jacinto Upper Pressure subbasin are susceptible to subsidence.

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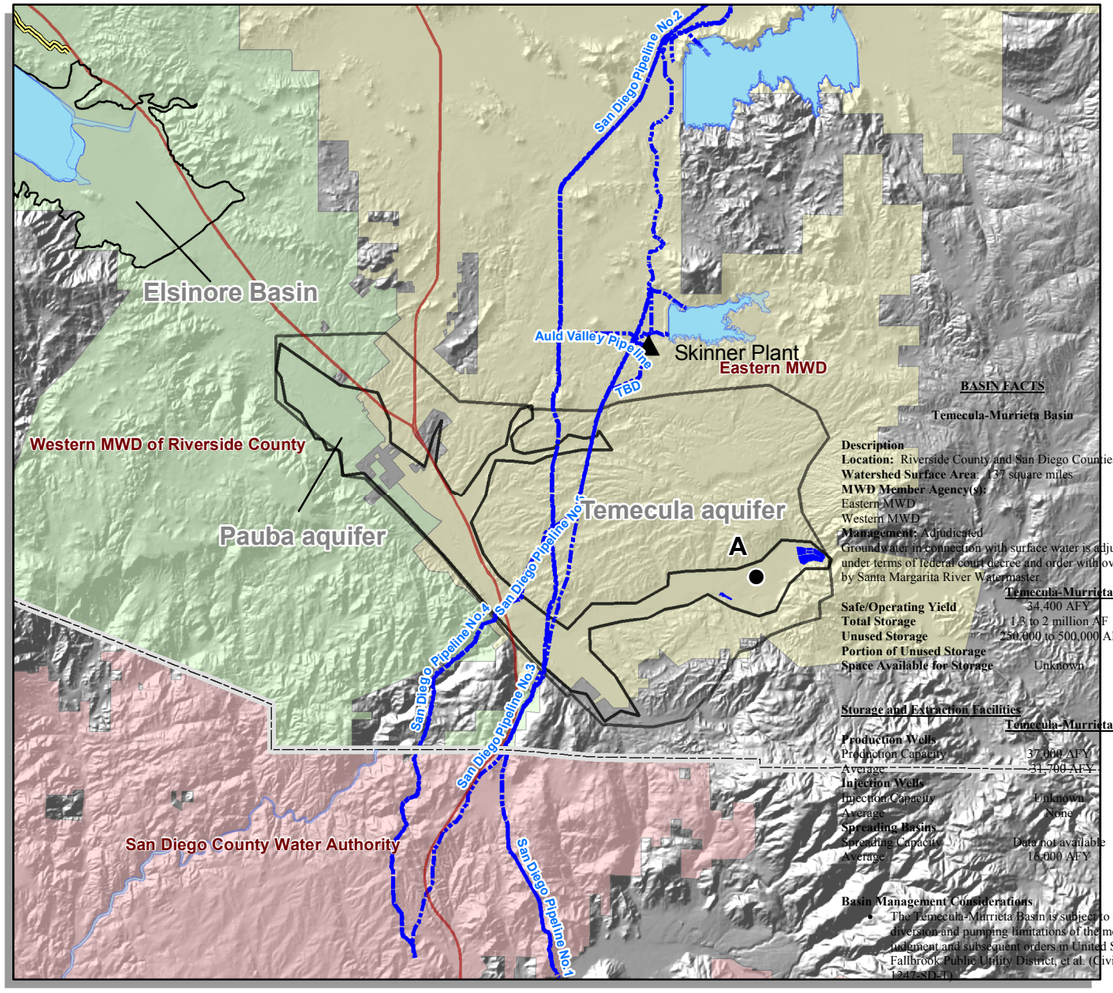


## Temecula-Murrieta Basin

Key well
Recharge Basins
County
Freeways
River
Water Body
MWD Pipeline
MWD Facility
Santa Ana Regional Interceptor Line
Basin
MWD Member Agency Boundary (color varies)

N W E S

3 1.5 0 3 Miles

Note: This map was prepared by the Metropolitan Water District of Southern California for its own use. No warranty is expressed or implied as to the correctness, timeliness, or content of the information shown herein.

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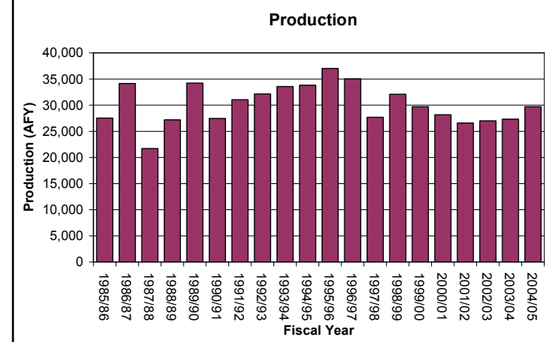
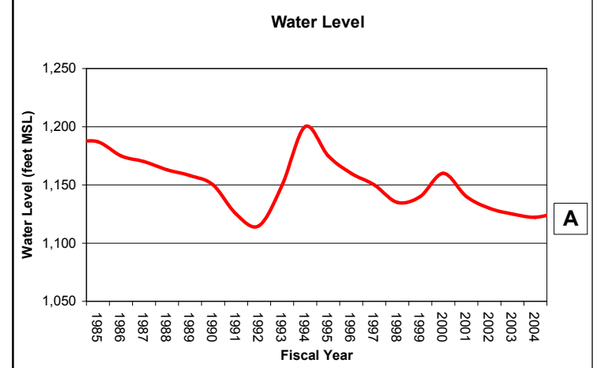
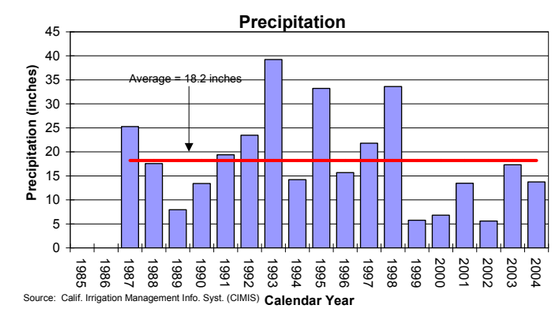
Additional Data Sourse(s): Santa Ana Watershed Project Authority (SAWPA); California Spatial Information Library (CaSIL).




Source: Calif. Irrigation Management Info. Syst. (CIMIS)

**Direct Recharge**
**Historical annual recharge data not available for this basin.**

## BASIN FACTS

### Temecula-Murrieta Basin

**Description**
**Location:** Riverside County and San Diego Counties
**Watershed Surface Area**: 137 square miles
**MWD Member Agency(s):**
Eastern MWD
Western MWD
**Management:** Adjudicated
Groundwater in connection with surface water is adjudicated under terms of federal court decree and order with oversight by Santa Margarita River Watermaster.

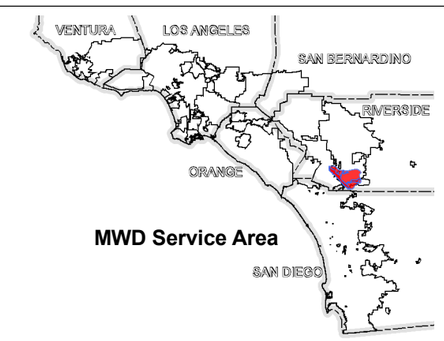
| | Temecula-Murrieta |
|---|---|
| **Safe/Operating Yield** | 34,400 AFY |
| **Total Storage** | 1.3 to 2 million AF |
| **Unused Storage** | 250,000 to 500,000 AF |
| **Portion of Unused Storage** | |
| **Space Available for Storage** | Unknown |

**Storage and Extraction Facilities**

| | Temecula-Murrieta |
|---|---|
| **Production Wells** | |
| Production Capacity | 37,000 AFY |
| Average | ~31,700 AFY |
| **Injection Wells** | |
| Injection Capacity | Unknown |
| Average | None |
| **Spreading Basins** | |
| Spreading Capacity | Data not available |
| Average | 16,000 AFY |

**Basin Management Considerations**

- The Temecula-Murrieta Basin is subject to the diversion and pumping limitations of the modified judgment and subsequent orders in United States v. Fallbrook Public Utility District, et al. (Civil No. 1247-SD-T)




**MWD Service Area**

**Plate 19-1**
**Overview of Temecula-Murrieta Basin**

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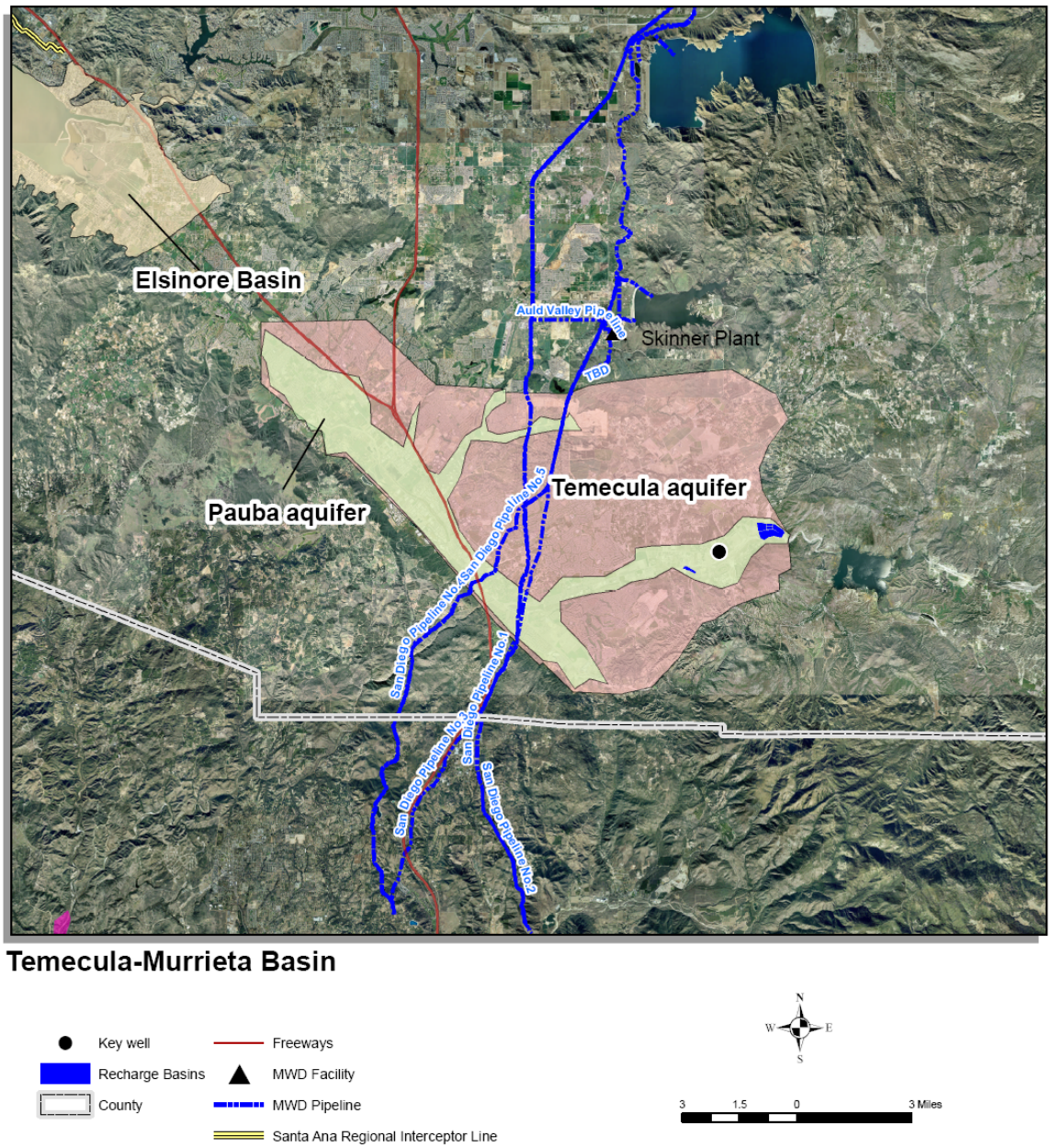
The Temecula-Murrieta Basin underlies several valleys in southwestern Riverside County and a portion of northern San Diego County. Alluvial sediments extend through the Pauba, Temecula-Murrieta, Santa Gertrudis, and Wolf valleys. These basins underlie the Metropolitan member agency service areas of Eastern Municipal Water District (Eastern MWD) and Western Municipal Water District (Western MWD). A map of the Temecula-Murrieta Basin is provided in **Figure 19-1**.

**Figure 19-1**
**Map of the Temecula-Murrieta Basin**



## BASIN CHARACTERIZATION

The following section provides a physical description of the Temecula-Murrieta Basin, including its geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

There are two aquifers within the Temecula-Murrieta Basin: the Pauba aquifer and the Temecula aquifer. Within these two aquifers, Rancho California Water District (RCWD) has identified eight underlying groundwater basins, which are based upon surface water hydrology subbasins: Pauba Valley Basin, Lower Mesa Basin, Upper Mesa Basin, North Murrieta Basin, South Murrieta Basin, San Gertrudis Basin, Wolf Valley Basin, and Palomar Basin. For purposes of this report, the extent of the groundwater basins is defined by the extent of the principal aquifers rather than surface water designations. The Pauba aquifer consists of younger, unconfined alluvium deposited within the Temecula-Murrieta Basin. The deeper Temecula aquifer is semi-confined and confined, and underlies and extends beyond the boundaries of the Pauba aquifer. A description of each aquifer follows.

The Lancaster, Aguanga, and Agua Caliente faults and several strands of the Elsinore fault zone cross the basin and may affects groundwater movement. The Wildomar fault is a groundwater barrier that produces differences in water level and pressure in the northwestern part of the basin. Murrieta Hot Springs lie along an unnamed fault indicating that the fault affects subsurface flow (DWR, 2004). Significant differences in water levels can occur across this fault and RCWD reports that pumping wells on one side of this fault do not discernibly affects the piezometric levels on the other side of the fault.

#### Pauba aquifer

The Pauba aquifer covers approximately 18 square miles. Alluvial sediments extend through Pauba Valley, Temecula-Murrieta Valley, Santa Gertrudis Valley, and Wolf Valley. The Pauba Valley occurs along Temecula Creek and extends approximately seven miles westward from Vail Lake. Well yields in the unconfined alluvial aquifer of the Pauba Valley are excellent, and typically range from 500 gpm to 2,000 gpm. The Pauba aquifer is underlain by the confined Temecula aquifer. The storage capacity of the Pauba aquifer has been estimated at 200,000 AF.

#### Temecula aquifer

The Temecula aquifer extends over an area of approximately 100 square miles and is comprised of consolidated sediments that underlie and extend beyond the boundaries of the Pauba aquifer. Sediment depths within the Temecula aquifer are typically 1,000 feet or more. Except for upstream forebay areas, confining layers separate the Pauba and Temecula aquifers, and groundwater is confined or semi-confined throughout the Temecula aquifer. RCWD reports well yields ranging from several hundred gpm to approximately 2,000 gpm.

Estimates for the amount of groundwater stored within the Temecula aquifer vary widely. The Santa Margarita River Watermaster estimated total groundwater storage in the uppermost

500 feet at 1,340,556 AF as of September 30, 2001. RCWD reports total groundwater storage with the Temecula aquifer at approximately 2 million AF. DWR reports groundwater storage within the Pauba and Temecula aquifers at approximately 250,000 AF. Estimates of unused storage range from 250,000 to 500,000 AF. The amount of this storage that is available is unknown.

A summary of the hydrogeologic parameters of the Temecula-Murrieta Basin is presented in **Table 19-1**.

**Table 19-1**
**Summary of Hydrogeologic Parameters of Temecula-Murrieta Basin**

| **Parameter** | **Description** |
|---|---|
| **Structure** | |
| Aquifer(s) | Temecula aquifer<br>Pauba aquifer |
| Depth of groundwater basin | >2,500 feet |
| Thickness of water-bearing units | Temecula aquifer: 1,000 feet or more<br>Pauba aquifer: 50 to 250 feet |
| **Yield and storage** | |
| Natural safe yield | 34,400 AFY |
| Total Storage | 1.34 to 2 million AF |
| Unused Storage | Temecula and Pauba aquifers:<br>250,000 to 500,000 AF |
| Portion of Unused Storage Available for Storage | Unknown |

Source: DWR, 2004; RCWD, 2005; Anchor Environmental, 2004; and Santa Margarita River Watermaster, 2006

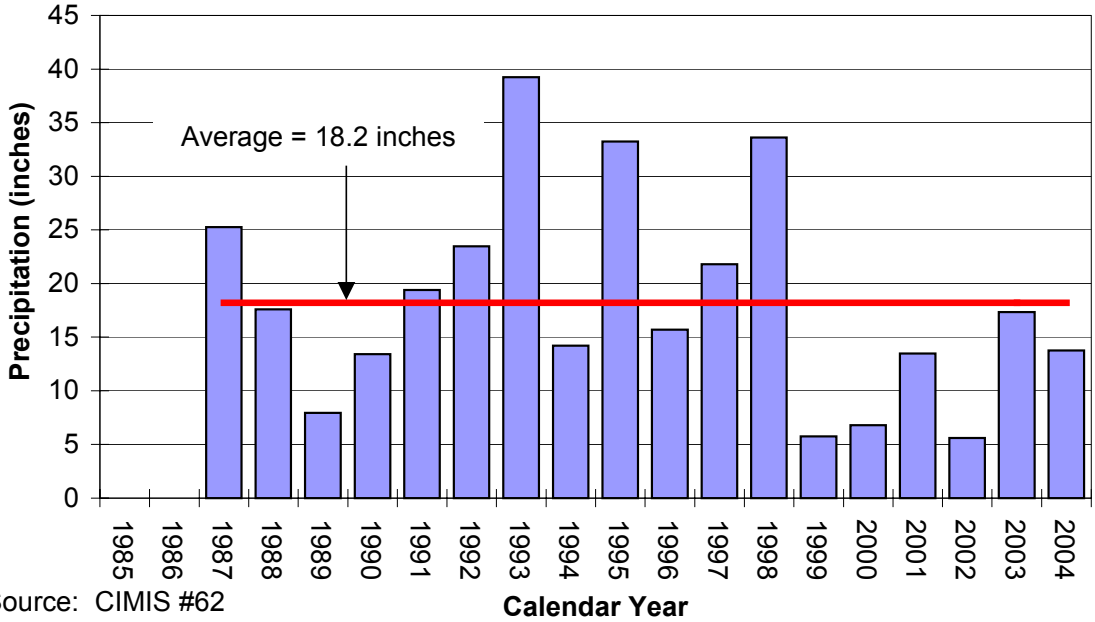
**Safe Yield/Long-Term Balance of Recharge and Discharge**

Average precipitation in the Temecula-Murrieta Basin is about 18.2 inches per year. **Figure 19-2** presents historical precipitation at the California Irrigation Management Information System (CIMIS) station Temecula #62. Extremely wet years occurred in 1993, 1995 and 1998. Very dry years occurred in 1989, 1999, 2000, 2001, and 2002.

According to RCWD's groundwater model, the average natural inflow (recharge, return flow, stream percolation and underflow) for all eight basins is 41,000 AFY when no artificial recharge is occurring (CDM, 2005). There are seven years in which the natural inflow has exceeded

70,000 AFY. The average natural basin outflow for all eight groundwater basins from 1935 to 1998 was 6,600 AFY. RCWD has estimated the natural yield of the eight basins equals the natural inflows less the natural losses, which would be 34,400 AFY (CDM, 2005). Parties in the watershed are continuing to evaluate the safe yield. Further descriptions on the recharge characteristics of the Pauba and Temecula aquifers follow.

**Figure 19-2**
**Historical Precipitation in the Temecula-Murrieta Basin**




Source: CIMIS #62

**Pauba aquifer**

As discussed above, the alluvial sediments of the Pauba aquifer extend through four valleys: Pauba Valley, Temecula-Murrieta Valley, Santa Gertrudis Valley, and Wolf Valley. The upstream portion of the Pauba Valley is a key forebay that recharges both the Pauba aquifer and the underlying Temecula aquifer. Pauba aquifer depths downstream from the forebay are typically in excess of 100 feet and extend to depths of more than 250 feet.

The Temecula-Murrieta Valley extends along Murrieta Creek northward from the Santa Margarita River confluence. The Murrieta forebay is located in the upstream portion of the valley, and the forebay recharges both the alluvial sediments of the Temecula-Murrieta Valley and the underlying Temecula aquifer. Downstream from the forebay, confining layers separate overlying alluvial sediments from the underlying Temecula aquifer. Sediment depths in the unconfined portion of the valley (Pauba aquifer) are typically in excess of 100 feet in depth, and extend to a maximum depth of approximately 200 feet.

The Santa Gertrudis Valley is a long and narrow valley that extends eastward from the Temecula-Murrieta Valley along Santa Gertrudis Creek. A forebay exists at the upstream end of

the valley that recharges both the unconfined alluvial sediments of the valley (Pauba aquifer) and the underlying confined Temecula aquifer. The Pauba aquifer depths downstream from the forebay typically range from 50 to 100 feet.

Wolf Valley extends southward approximately three miles from the confluence of Pechanga Creek and Temecula Creek. A forebay exists at the upstream (south) end of Wolf Valley that recharges both the unconfined alluvial sediments of the Wolf Valley (Pauba aquifer) and the underlying Temecula aquifer. Pauba aquifer depths downstream from the Wolf Valley forebay range from 50 to 80 feet.

#### Temecula aquifer

The Temecula aquifer is a deeper, confined or semi-confined aquifer below the Pauba aquifer. Streamflow infiltration in unconfined alluvial forebays represents the primary source of recharge to the Temecula aquifer. Such streamflow infiltration recharge occurs in upstream forebays within Pauba Valley, Wolf Valley, Temecula-Murrieta Valley, and Santa Gertrudis Valley. In addition, portions of the Temecula aquifer are exposed in the upland mesa portion of eastern Temecula, allowing for recharge through streamflow infiltration, applied water infiltration, and precipitation infiltration.

## GROUNDWATER MANAGEMENT

The following section describes how the basins are currently managed.

### Basin Governance

As part of the Santa Margarita River system, surface water and groundwater supporting surface water (defined as being in the older and younger alluvium) with the Temecula-Murrieta Basin have been under some form of court jurisdiction since 1928. Groundwater basins not contributing the Santa Margarita River system are not adjudicated. A summary of the governing agencies and their roles is presented in **Table 19-2**.

Rights to utilize surface water and groundwater determined to be contributing to the Santa Margarita River are governed by the Modified Final Judgment and Decree entered on April 6, 1966 by the U.S. District Court in United States v. Fallbrook Public Utility District, et al. (Civil No. 1247-SD-T). The Modified Final Judgment incorporates the 1940 Stipulated Judgment and several subsequent orders have been entered that provide provisions for administering the water rights and managing surface water and groundwater resources in the watershed. The subsequent orders include the Cooperative Water Resource Management Agreement between RCWD and Camp Pendleton for management of groundwater and maintenance of surface water flows. Other governance documents include Permit 7032 issued by the State Water Resources Control Board for water rights in Vail Lake and a recently adopted agreement between RCWD and the Pechanga Band concerning groundwater management for the Wolf Valley subbasin.

In March 1989, the Court appointed a Watermaster to administer and enforce the provisions of the Modified Final Judgment and Decree and subsequent orders of the Court. The Court also appointed a Steering Committee that is currently comprised of representatives from the United States, Eastern Municipal Water District, Western Municipal Water District, Fallbrook Public Utility District, Metropolitan, the Pechanga Tribe, and RCWD. The purpose of the Steering Committee to assist the Court and the Watermaster in administering the water rights (Santa Margarita River Watershed Watermaster Report 2006).

**Table 19-2**
**Summary of Management Agencies in the Temecula-Murrieta Basin**

| Agency | Role |
|---|---|
| Santa Margarita River Watershed Watermaster | Court-appointed Watermaster for oversight and administration of water rights |
| Santa Margarita River Watershed Steering Committee | Assist the Court and the Watermaster in administering the water rights |
| Rancho California Water District | Prepares Groundwater Audit and Recommended Groundwater Production Report for operation of District groundwater wells and recharge facilities |

In addition, each year the RCWD prepares a Groundwater Audit and a Recommended Groundwater Production Report (RGPR). The amount of groundwater that can be produced varies due to such factors as rainfall, recharge area, and amount and location of well pumping capacity (RCWD, 1997).

### Interactions with Adjoining Basins

The Temecula-Murrieta Basin is adjacent to the Elsinore Basin. When groundwater levels are above 1,100 feet MSL in the southeastern portion of the Elsinore Basin, small amounts (less than 100 AFY) of groundwater could spill into the adjacent Temecula-Murrieta Basin (MWH, 2003a). Current water levels are substantially below this level, and there are no agreements regarding this potential flow.

## WATER SUPPLY FACILITIES AND OPERATIONS

The following section presents information on water supply facilities and operations. Facilities include more than 70 groundwater production wells, 4 groundwater recovery wells and spreading basins. Each of these facilities is discussed in more detail below.

**Active Production Wells**

A summary of production wells in the Temecula-Murrieta Basin is presented in **Table 19-3**.

The agencies that pump from the eight basins include RCWD, Eastern MWD, Western MWD (inclusive of Murrieta County Water District (MCWD), which was acquired by Western MWD in 2005), the Pechanga Indian Reservation, and other private pumpers (RCWD, 2005). Well yields generally range to 300 gpm in the northwestern part of the basin, but reach 1,750 gpm for wells in Pauba Valley (DWR, 2004). RCWD, the largest of these agencies, encompasses almost 100,000 acres and provides retail water supply for a variety of agricultural and residential uses. Typical agricultural uses include avocados, citrus, and grapes while residential demands are for the rapidly growing cities of Temecula and Murrieta (RCWD, 1997).

**Table 19-3**
**Summary of Production Wells in the Temecula-Murrieta Basin**

| Category | Number of Wells | Estimated Production Capacity (AFY) | Average Production 1985/86 2004/05 (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| Municipal | 49 | Data not available | 29,845 | Data not available |
| Private "Substantial Users" | 11 | | 1,952 [1] | |
| **Totals** | **>60** | | **31,797** | |

Sources: Santa Margarita River Watermaster, 2006; Santa Margarita River Watershed Management Plan, Watershed Assessment Report Draft, 2004; RCWD, 2006
[1]Private party pumping is for 2004/05 only

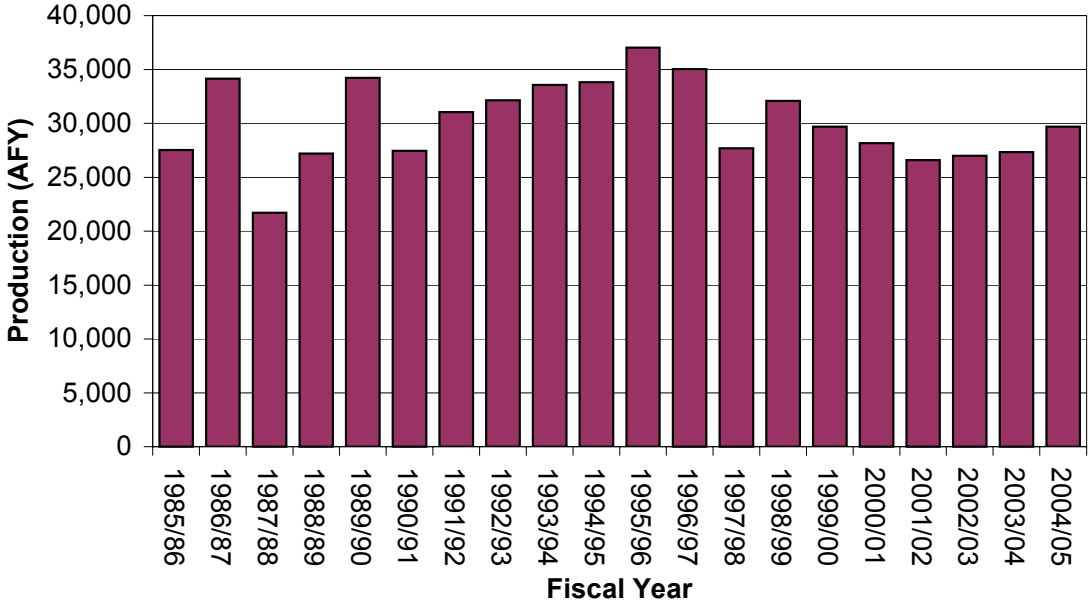
RCWD maintains more than 100 production and monitoring wells within the Temecula-Murrieta Basin. RCWD currently has 44 production wells in the eight basins with a total instantaneous capacity of 90 cfs, not including four groundwater recovery wells in the Valle de los Caballos project. Total RCWD groundwater pumping is dependent on water demands and hydrologic conditions, but RCWD typically derives 40 to 50 percent of its total water supply from local groundwaters of the Pauba and Temecula aquifers. From 1985/86 to 2004/05, RCWD groundwater production ranged from 21,400 AFY to 36,100 AFY, averaging 29,000 AFY (Santa Margarita River Watermaster, 2006).

Eastern MWD has historically derived a small percentage of its domestic water supply from wells within the Temecula-Murrieta Basin. From fiscal year 1985/86 to 2004/05, Eastern MWD groundwater production from the Temecula-Murrieta Basin ranged from 0 AFY to 685 AFY, averaging 301 AFY (Santa Margarita River Watermaster, 2006). In 2004, Eastern MWD destroyed its one remaining well in the Temecula-Murrieta Basin.

Groundwater served as the primary source of water supply for MCWD, which was acquired by Western MWD in 2005. Western MWD derives it supply from a combination of groundwater and imported surface water. Western MWD operates five water supply wells within the north end of the Temecula-Murrieta Basin. From 1985-86 to 2004-05, MCWD groundwater production from the Temecula-Murrieta Basin ranged from 286 AFY to 2,098 AFY, averaging 845 AFY, with production increasing significantly in recent years (Santa Margarita River Watermaster, 2006).

Historical municipal groundwater production for the Temecula-Murrieta Basin is presented in **Figure 19-3**. This figure does not include the production from substantial private users outside of these organized service areas.

**Figure 19-3**
**Historical Groundwater Production in the Temecula-Murrieta Basin**
**(Within Organized Service Areas Only)**




Source: Santa Margarita River Watermaster, 2006

Agricultural demands continue to be a significant part of the RCWD demands, as shown in **Figure 19-4**. However, increased residential and commercial development in the Temecula-Murrieta Basin will result in greater domestic/commercial demands over time.

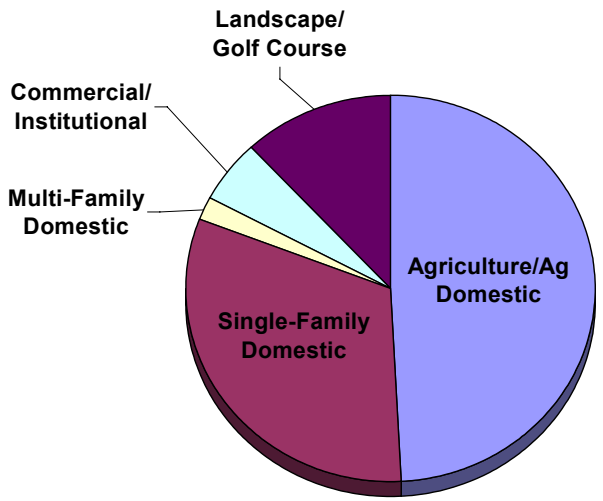
**Other Production**

It is important to note that as a condition to receiving RCWD water service, RCWD requires local water users to convey overlying groundwater rights to RCWD. As a result, virtually no private groundwater wells exist within the RCWD service area. Outside of the RCWD service area, however, dozens of private well owners pump groundwater within the Temecula-Murrieta

Basin. Most of the private wells are within the upstream portion of the Murrieta Valley, and are used for domestic or irrigation supply at private residences. In 2004-05, the Santa Margarita River Watermaster identified a total of eight private water users within the Temecula-Murrieta Basin as being "substantial users." During 2004-05, approximately 1,950 AF of groundwater was produced by these "substantial users" (Santa Margarita River Watermaster, 2006).

The Pechanga Indian Reservation is one of these "substantial users" and develops its potable and irrigation supplies from 11 onsite wells within the Temecula-Murrieta Basin. During 2004-05, the Pechanga Indian Reservation produced 608 AF of groundwater from the Temecula-Murrieta Basin (Santa Margarita River Watermaster, 2006).

**Figure 19-4**
**Year 2000 Consumptive Water Demands in RCWD Service Area**




Source: RCWD Urban Water Management Plan, 2005

RCWD's Vail Dam appropriative right provides that RCWD may store up to 40,000 AF in Vail Reservoir each year between November 1 and April 30, subject to limitations, and that the water so stored may be used for irrigation and domestic uses incidental to farming operations on 3,797 acres of land between May 1 and October 31. Such use may be by direct diversion from Vail Lake or by recovery with wells of water released from Vail and spread downstream in Pauba Valley. The amount of local runoff reaching the lake can vary widely depending on hydrological conditions. From 1962 to 2000, flows into Vail Lake ranged from 218 AFY to 29,570 AFY, with an average flow of 5,150 AFY. The storage capacity of the lake is approximately 40,000 AF, with a surface area of 1,000 acres. Currently, RCWD only uses Vail Lake to store local runoff. The historical available storage of the lake has varied widely as well,

including two periods when the reservoir was full in March 1984 and February 1997. The average available storage is approximately 30,900 AF.

**ASR Wells**

RCWD operates four groundwater recovery wells – the Valle de los Caballos wells – at the Valle de los Caballos spreading basins discussed below.

**Spreading Basins**

In addition to the extraction of the natural yield of the basins, RCWD artificially recharges the Temecula-Murrieta Basin with untreated imported water for enhanced groundwater production. RCWD purchases imported water from Metropolitan and delivers it from the San Diego aqueduct turnout EM-19 to the Valle de los Caballos (VDC) recharge basins. In the past, the VDC recharge basins have provided up to 16,000 AFY of artificial groundwater recharge.

RCWD stores local runoff in Vail Lake, which was created in 1948 through construction of Vail Dam on Temecula Creek. RCWD has a surface water storage permit in Vail Lake for up to 40,000 AF from November 1 to April 30. During these months, RCWD releases available water from Vail Lake to the VDC spreading basins, about 1.5 miles downstream, for groundwater recharge. From May through October, existing State permits prohibit storage and require inflow to pass through Vail Lake to Temecula Creek (CDM, 2005).

**Seawater Intrusion Barriers**

There are no seawater barriers in the Temecula-Murrieta Basin.

**Desalters**

There are no desalters in the Temecula-Murrieta Basin

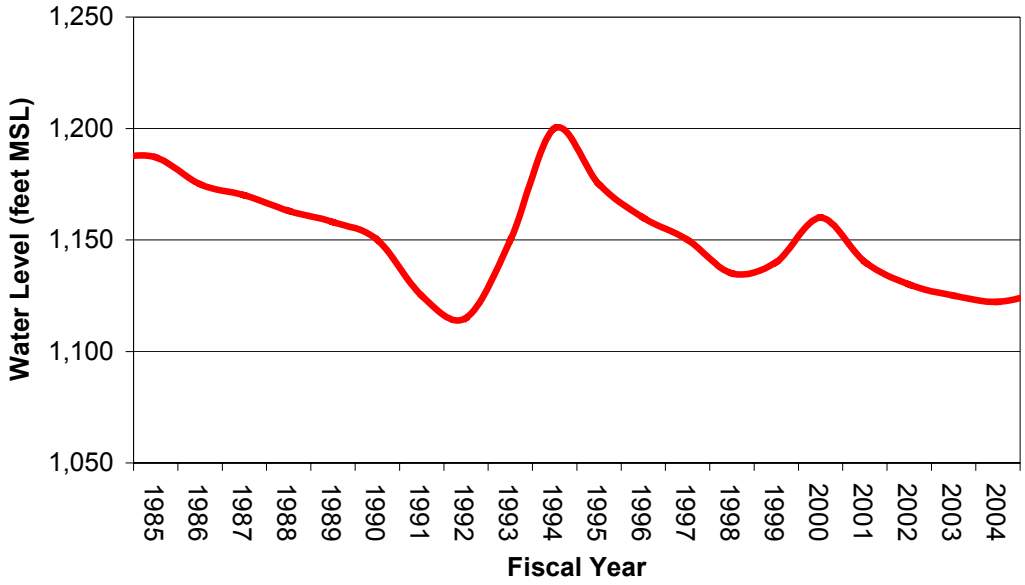
## GROUNDWATER LEVELS

In general, groundwater flows southeastward under the Temecula-Murrieta Valley and southwestward beneath Pauba Valley to the southwestern part of the basin. A hydrograph of a monitoring well below Vail Lake within the Pauba aquifer is provided in **Figure 19-5**. This figure shows declines of about 70 feet and 60 feet between 1985 to1992 and 1995 to 1999, respectively, with recoveries following each period. Water levels in this portion of the basin have declined about 75 feet since 1994. Water levels in other portions of the basin show similar trends.

## GROUNDWATER QUALITY

This following section presents information on the groundwater quality of the Temecula-Murrieta Basin.

**Figure 19-5**
**Historical water Levels in the Temecula-Murrieta Basin**




Source: Santa Margarita River Watermaster, 2006.

## Groundwater Quality Monitoring

RCWD continually monitors the water quality of the eight groundwater basins and its 44 wells. Every year RCWD conducts over 2,000 tests for water quality on its wells and distribution system.

## Groundwater Contaminants

Constituents of concern for the Temecula-Murrieta Basin are summarized in **Table 19-4**. These include: total dissolved solids (TDS), nitrate, volatile organic compounds (VOCs), perchlorate, fluoride and manganese. Groundwater in most of the Pauba aquifer and the Temecula aquifer is generally suitable for domestic and irrigation uses. TDS concentrations in the lower, confined and semi-confined Temecula aquifer tend to be lower than in the Pauba aquifer, though the percent sodium is higher in the Temecula aquifer. Nitrate (as N) levels are typically in compliance with the 10 mg/L MCL, although nitrate (as N) levels have been found to be higher in the wells in the Santa Gertrudis Valley. Sampling at RCWD's wells between 2002 and 2004 has indicated that the primary MCL standard of 2 mg/L for fluoride has been exceeded. However, well water is blended with other well water and imported MWD water and the distribution system average level of fluoride was well below the MCL. Well sampling has also indicated high levels for manganese, but blending reduces the manganese concentration to the non-detect level. Groundwater is rated inferior for domestic use locally near Murrieta Hot Springs because of high nitrate and fluoride content.

**Table 19-4**
**Summary of Constituents of Concern in the Temecula-Murrieta Basin**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL = 500 | mg/L | 200 to >1,000 | In the unconfined Pauba aquifer, TDS ranges from 450 mg/L to greater than 1,000 mg/L. In the semi-confined and confined Temecula aquifer, TDS ranges from 200 mg/L to 600 mg/L. Percent sodium in the TDS for the Temecula aquifer can range from 55 to over 80 percent. |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/L | 6.9 to 10 | Based on sampling of 25 RCWD wells in 2003-04. High levels near Murrieta Hot Springs. |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL TCE = 5<br>Primary MCL PCE = 5 | µg/L | ND | No known detections of TCE or PCE. |
| **Perchlorate**<br>Notification level = 6 | µg/L | ND to 6.6 | Detected in three RCWD wells since 2002. Only 1 well had a detection above notification level |
| **Fluoride**<br>Primary MCL = 2 | mg/L | 0.2 to 7.6 | A sampling of RCWD wells from 2002 to 2004. After blending with other well water and imported water, distribution system average was 0.4 mg/L. High levels near Murrieta Hot Springs. |
| **Manganese**<br>Secondary MCL = 50 | µg/L | 50 to 250 | RCWD wells. After blending with other well water and imported water, distribution system average was at non-detect level. |

Sources: Santa Margarita River Watershed Annual Watermaster Report, 2005; RCWD Urban Water Management Plan, 2005; Santa Margarita River Watershed Management Plan, Watershed Assessment Report Draft, 2004

**Blending Needs**

RCWD blends groundwater with imported water from Metropolitan to reduce fluoride concentrations and manganese concentrations.

**Groundwater Treatment**

Agencies chlorinate the groundwater. Data related to other treatment is currently not available.

## CURRENT GROUNDWATER STORAGE PROGRAMS

RCWD artificially recharges the Temecula-Murrieta Basin with untreated imported water for enhanced groundwater production. RCWD purchases imported water from Metropolitan and delivers it from the San Diego aqueduct turnout EM-19 to the Valle de los Caballos (VDC) recharge basins. In the past, the VDC recharge basins have provided up to 16,000 AFY of artificial groundwater recharge.

## BASIN MANAGEMENT CONSIDERATIONS

The following describes the basin management considerations for the Temecula-Murrieta Basin. They include:

- The Temecula-Murrieta Basin is subject to the diversion and pumping limitations of the modified judgment and subsequent orders in United States v. Fallbrook Public Utility District, et al. (Civil No. 1247-SD-T), and to other local surface water diversion and groundwater pumping rights.

- Each year the RCWD prepares a Groundwater Audit and a Recommended Groundwater Production Report (RGPR). The amount of groundwater that can be produced varies due to such factors as rainfall, recharge area, and amount and location of well pumping capacity.

**References:**

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# CHAPTER IV

# GROUNDWATER BASIN REPORTS

# SAN DIEGO COUNTY BASINS

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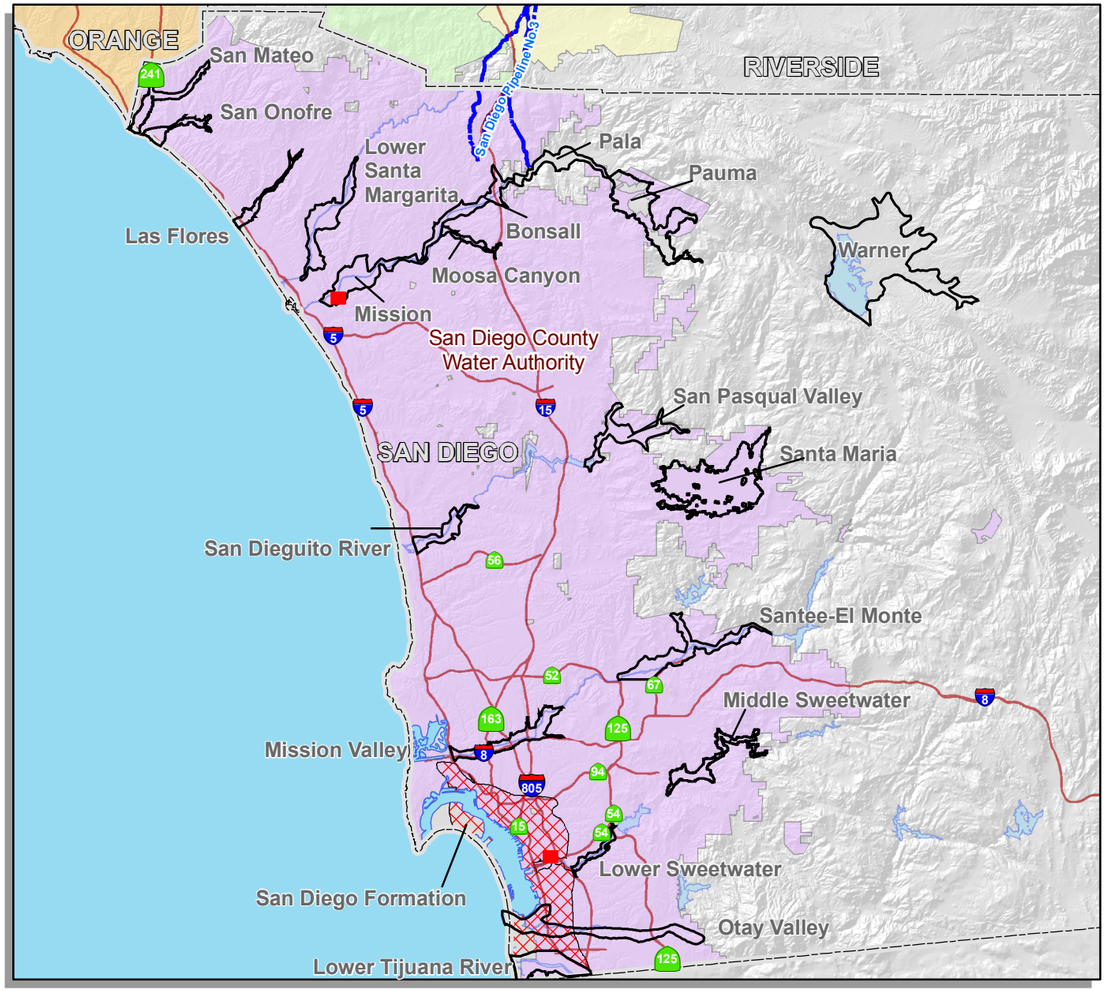


## San Diego County Basins

Freeways
MWD Pipeline
County
Desalter
Water Body
MWD Member Agency Boundary (color varies)
Groundwater Basin
San Diego Formation

N W E S

9 4.5 0 9 Miles

Note: This map was prepared by the Metropolitan Water District of Southern California for its own use. No warranty is expressed or implied as to the correctness, timeliness, or content of the information shown herein.

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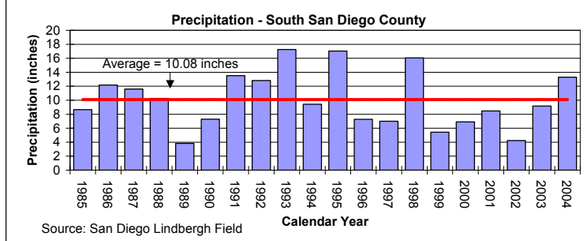
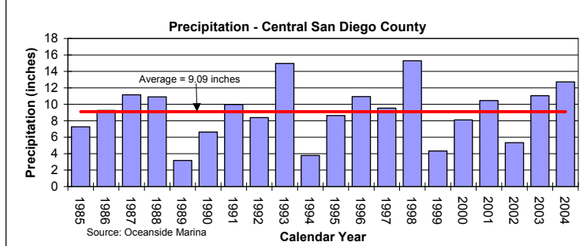
Additional Data Sourse(s): Santa Ana Watershed Project Authority (SAWPA); California Spatial Information Library (CaSIL).

### Production

| Basin | Average Production (AFY) | Safe Yield (AFY) |
|---|---|---|
| **North San Diego County** | | |
| San Mateo | 2,000 | 3,180 |
| San Onofre | 500 | 1,420 |
| Las Flores | 400 | 600 |
| **Subtotals (w/available data)** | **2,900** | **5,200** |
| **Central San Diego County** | | |
| Lower Santa Margarita River | 5,800 | 5,400-16,700 |
| San Luis Rey River | | |
| • Mission | 4,200 | 7,000-10,000 |
| • Bonsall | 2,500 | 5,400 |
| • Pala/Pauma | 7,700 | 8,000 |
| • Moosa Canyon | Data not available | Data not available |
| • Warner Basin | 7,000 | 12,000 |
| San Dieguito River | | |
| • San Dieguito Valley | 2,500 | <2,500 |
| • San Pasqual Valley | 4,000 | 5,800 |
| • Santa Maria | 250 | >2,500 |
| **Subtotals (w/available data)** | **33,950** | **48,600-62,900** |
| **South San Diego County** | | |
| Sweetwater & San Diego Formation | | |
| • Lower Sweetwater | | 2,400 |
| • Middle Sweetwater | 7,490 | 3,000 |
| • San Diego Formation | | 3,000-5,000 |
| Santee-El Monte | 5,600 | 3,000-4,000 |
| Other | | |
| • Mission Valley | 807 | 2,000-4,000 |
| • Otay Valley | Data not available | Data not available |
| • Lower Tijuana River Valley | 887 | 5,000-6,800 |
| **Subtotals (w/available data)** | **14,784** | **18,400-25,200** |
| **TOTALS (w/available data)** | **51,634** | **72,200-93,300** |




### BASIN FACTS

#### San Diego County

**Description**

**Location:** San Diego County

**Watershed Surface Area:**
South County: 2,640 square miles
Central County: 1,416 square miles
North County: 150 square miles

**Basins**

**Central County**
Lower Santa Margarita River
- Upper Ysidora
- Chappo
- Lower Ysidora

San Luis Rey River
- Mission
- Bonsall
- Moosa Canyon
- Pala
- Pauma
- Warner

San Dieguito River
- San Dieguito Valley
- San Pasqual Valley
- Santa Maria

**South County**
Sweetwater & San Diego Formation
- Lower Sweetwater
- Middle Sweetwater
- San Diego Formation

Santee-El Monte
Other
- Mission Valley
- Otay Valley
- Lower Tijuana River Valley

**North County**
San Mateo
San Onofre
Las Flores

**Management:** Adjudicated, Managed, Unadjudicated
Court appointed Watermaster for Lower Santa Margarita River Basins in 1989. Adopted groundwater management plan for Lower Tijuana River Valley in 1995. Other basins are unadjudicated.

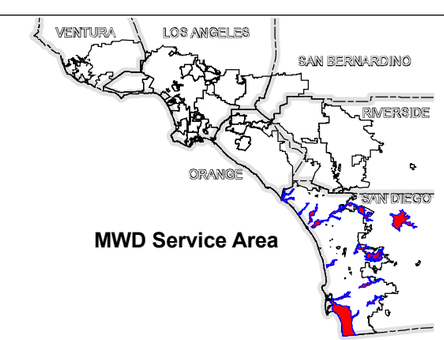
**MWD Member Agencies:**
San Diego County Water Authority

| | North County | Central County | South County |
|---|---|---|---|
| **Natural Safe Yield** | 5,200 AFY | 48,600-62,900 AFY | 18,400-25,200 AFY |
| **Total Storage** | 21,400 AFY | 913,100-974,200 AF | 1.1-1.2 million AF |
| **Unused Storage** | Unknown | 9,000 AF | 60,000-110,000 AF |
| **Portion of Unused Storage Available for Storage** | Unknown | Unknown | At least 18,860 AF |

**Storage and Extraction Facilities**

| | North County | Central County | South County |
|---|---|---|---|
| **Production Wells** | | | |
| Production Capacity | Data not available | Data not available | Data not available |
| Average | 2,900 AFY | 33,950 AFY | 14,784 AFY |
| **Injection Wells** | | | |
| Injection Capacity | Data not available | Data not available | None |
| Average | Data not available | Data not available | None |
| **Spreading Basins** | | | |
| Spreading Capacity | Data not available | 4,000 AFY | None |
| Average | Data not available | Data not available | None |

**Basin Management Considerations**
- Water quality (TDS, chloride, sulfate, magnesium, nitrate, fluoride, iron, manganese, and selenium) limit potential for storage and extraction.
- Potential for storage and extraction in certain basins could be limited due to size of basin and the ability to store and transmit water.




**MWD Service Area**

## Plate 20-1
## Overview of San Diego County Basins

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The groundwater basins of San Diego County have been grouped in three geographic sections that follow: North San Diego County Basins, Central San Diego County Basins, and South San Diego County Basins. The basins discussed are generally recognized by the San Diego County Water Authority (SDCWA.). These basins either fall within the SDCWA service area, or lie outside their service while providing water to their service area.

**NORTH SAN DIEGO BASINS**

The North San Diego County Basins include: San Mateo, San Onofre, and Las Flores Basins.

**CENTRAL SAN DIEGO BASINS**

The Central San Diego County Basins include: the Lower Santa Margarita River Basin (Upper Ysidora, Chappo, and Lower Ysidora Basins), the San Luis River Basins (Mission, Bonsall, Pala, Pauma, Moosa Canyon, and Warner Basins), and the San Dieguito River Basins (San Dieguito Valley, San Pasqual Valley, and Santa Maria Basins).

**SOUTH SAN DIEGO BASINS**

The South San Diego County Basins include: San Diego Formation and the Lower Sweetwater, Middle Sweetwater, Santee-El Monte, Mission Valley, Otay Valley, and Lower Tijuana River Valley Basins.

**SUMMARY**

Based upon available data, the natural safe yield of the San Diego Basins ranges from 72,200 to 93,300 AFY. The production of the San Diego Basins was estimated at 51,600 AFY, again based on available data. An overview of the San Diego County Basins is presented in **Table 20-1**. Detailed descriptions of each basin by geographic region follow.

**Table 20-1**
**San Diego County Basins Overview**

| Basin | Natural Safe Yield | Basin Management | Facilities and Operations | Water Quality Concerns |
|---|---|---|---|---|
| **North San Diego County Basins** | **5,200 AFY (using available data)** | | **Production for Camp Pendleton: 10 potable wells w/production of 2,900 AF** | |
| San Mateo Basin | 3,180 AFY | **Unadjudicated** No formal management structure for these basins | • Production: :2,000 AFY | TDS: 400 – 700 mg/L |
| San Onofre Basin | 1,420 AFY | | • Potable production: 500 AFY | TDS: 300 – 800 mg/L |
| Las Flores Basin/Las Pulgas Basin | 600 AFY | | • Potable production: 400 AFY | TDS 600 – 900 mg/L |
| **Central San Diego County Basins** | **48,600 to 62,900 AFY** | | **Total Central San Diego Production: 33,950 AFY (using available data)** | |
| Lower Santa Margarita River Basins | 5,400 to 16,700 AFY | **Adjudicated** Adjudicated by the Court with decree entered on April 6, 1966 and administered by the Santa Margarita River Watermaster and the Watershed Steering Committee | • Potable- (80%) and agricultural (20%) supply for Camp Pendleton with total average production of 5,800 AFY<br>• Recharge Basins: 65 acres managed by Camp Pendleton for spreading diverted river water | TDS: 325 – 1,260 mg/L<br>Magnesium, sulfate, chloride and nitrate high for potable purposes. |
| San Luis Rey River Valley Basins | 32,400 to 35,400 AFY | **Unadjudicated** Informal management via San Luis Rey Watershed Council | • Municipal production: 11,900 AFY<br>• Other production: 9,500 AFY | TDS: 168- 3,400mg/L<br>Warner, Pala and Pauma basins range from 168-900mg/L TDS. Other basins higher.<br>Nitrates: Pala/Pauma basins high<br>Manganese: Mission Basin high |
| San Dieguito River Basins | 10,800 AFY | **Unadjudicated** San Dieguito Basin Task Force evaluating feasibility of groundwater management | • Total production: 6,750 AFY<br>• No municipal production | TDS: Downstream reaches 1,000 – 27,000 mg/L<br>Upstream areas: 320-1,680 mg/L<br>Selenium: Santa Maria basin wells shutdown |

**Table 20-1 (continued)**
**San Diego County Basins Overview**

| Basin | Natural Safe Yield | Basin Governance | Facilities and Operations | Water Quality Concerns |
|---|---|---|---|---|
| **South San Diego County Basins** | **18,400 to 25,200 AFY (using available data)** | | **Total South San Diego Production = 14,784 AFY (using available data)** | |
| Lower Sweetwater Basin | 2,400 AFY | **Unadjudicated**<br>Managed pursuant to Sweetwater Authority Interim Groundwater Management Plan | • 13 municipal wells serving Chula Vista, National City and Bonita averaging 4,590 AFY<br>o Reynolds Groundwater Desalination Facility (RO) treats brackish groundwater averaging 2,850 AFY and blended with untreated groundwater<br>o National City wells averaged 1,740 AFY<br>• Other production: 2,900 AFY | TDS of municipal wells ranging from 600 – 3,320 mg/L<br>Chloride 359 – 1,590 mg/L |
| Middle Sweetwater Basin | 3,000 AFY | | | |
| San Diego Formation | 3,000 to 5,000 AFY | | | |
| Santee-El Monte Basin | 3,000 to 4,000 AFY | **Unadjudicated**<br>Primary producer is Helix WD | • 9 active municipal wells with average production of 1,600 AFY<br>• 19 other wells with average production of 4,000 AFY | Iron and manganese: exceed MCLs in central portion of basin<br>TDS: 260 – 3,000 mg/L<br>Nitrate (as N): exceed MCL in central portion of basin |
| Mission Valley | 2,000 to 4,000 AFY | **Unadjudicated**<br>Conceptual groundwater management plan | • Production: 807 AFY (average of 500 gpm) | Generally poor:<br>TDS: 520 – 4,089mg/L<br>Chloride: 80 – 1640 mg/L<br>Sulfate: 68 – 607 mg/L<br>Nitrate: 0 – 105 mg/L |
| Lower Tijuana | 5,000 to 6,800 AFY | **Managed**<br>Adopted groundwater management plan in 1995 | • Production: 887 AFY (average of 550 gpm) | Problems with seawater intrusion<br>TDS: 379 – 1749 mg/L (1982-83)<br>Chloride: 83-650 mg/L (1982-83) |
| Otay Valley | Data not available | Data not available | Data not available | Data not available |
| **TOTALS** | **72,200 to 93,300 AFY (using available data)** | | **Total San Diego Production 51,634 AFY (using available data)** | |

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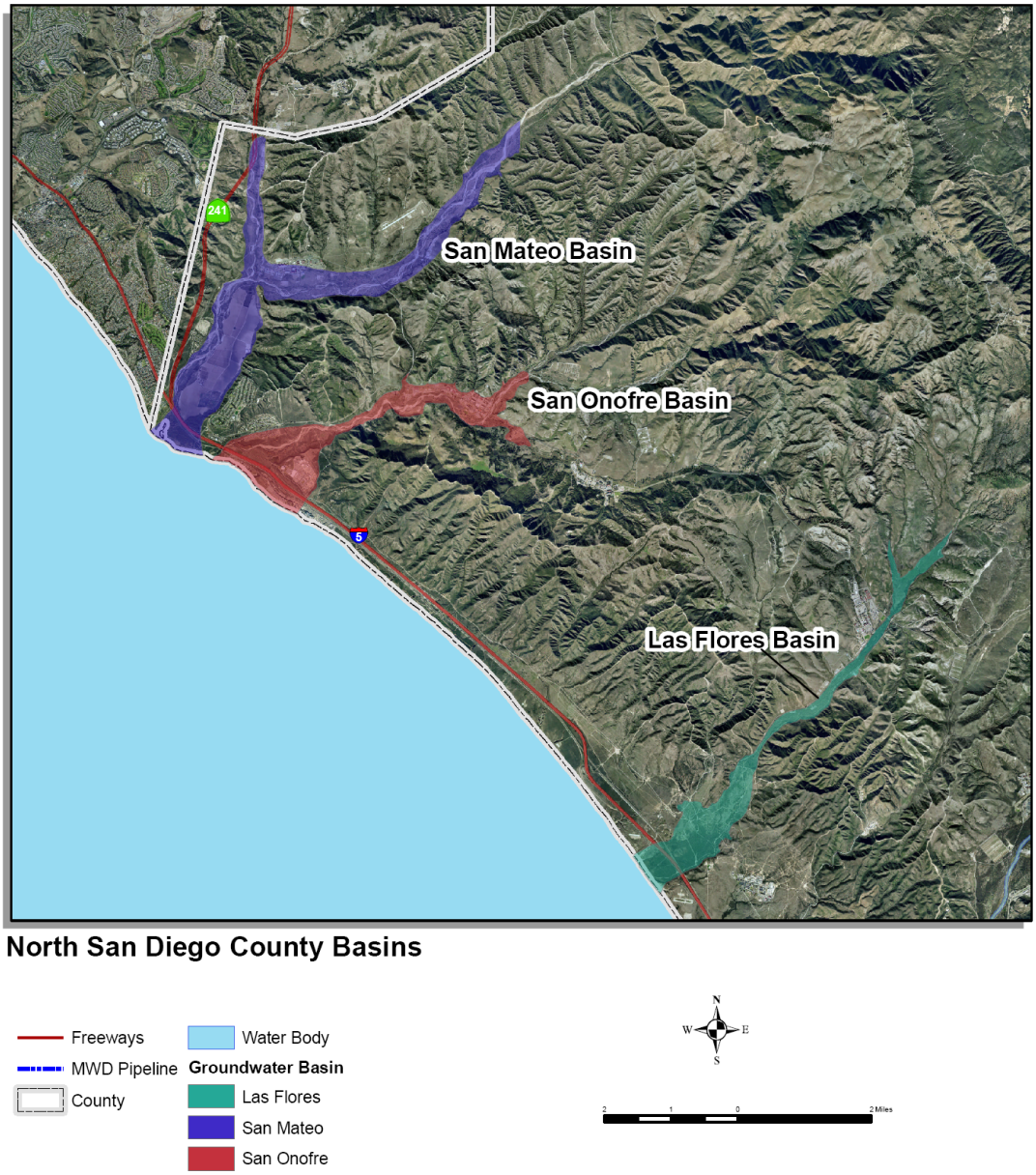
The groundwater basins in north San Diego County discussed in this section include: San Mateo Basin, San Onofre Basin, and Las Flores Basin. These basins consist of 496 square miles of drainage area in San Diego, Orange, and Riverside counties, with approximately 150 square miles located in northwest San Diego County. The North San Diego Basins underlie the service area of the San Diego County Water Authority (SDCWA). A map of the North San Diego County Basins is presented in **Figure 21-1**.

**Figure 21-1**
**Map of North San Diego County Basins**




Source: SDCWA, 1997

## BASIN CHARACTERIZATION

The following section presents the physical descriptions of the North San Diego County Basins.

### Basin Producing Zones and Storage Capacity

A summary of the aquifer characteristics of the North San Diego County Basins is presented in **Table 21-1**.

**Table 21-1**
**Summary of Hydrogeologic Parameters for North San Diego County Basins**

| Parameter | San Mateo Basin | San Onofre Basin | Las Flores Basin |
|---|---|---|---|
| Aquifer(s) | Unconfined alluvium | Unconfined alluvium | Unconfined alluvium |
| Depth of groundwater basin | Up to 100 feet | Up to 55 feet | Up to 100 feet |
| Storage Capacity | 6,500 AF | 6,500 AF | 8,400 AF |

Source: San Diego County Water Authority, Groundwater Report, 1997

#### San Mateo Basin

The San Mateo Basin underlies the San Mateo Valley and Christianitos Canyon in northwestern San Diego County and southeastern Orange County. The basin is bounded by the Pacific Ocean on the west and elsewhere by semi-permeable Tertiary marine sedimentary rocks. The valleys are drained westward to the ocean by San Mateo and Christianitos Creeks.

#### San Onofre Basin

The San Onofre Basin underlies the San Onofre Valley in northwestern San Diego County. The basin is bounded by the Pacific Ocean on the west and elsewhere by semi-permeable Tertiary marine sedimentary rocks. The valley is drained westward to the ocean by San Mateo Creek.

#### Las Flores Basin

The Las Flores Basin (also known as the Las Pulgas Basin) underlies Las Flores Creek. The basin is bounded by the Pacific Ocean on the west and elsewhere by semi-permeable Tertiary marine sedimentary rocks. The valley is drained westward to the ocean by Las Flores Creek.

### Safe Yield/Long-Term Balance of Recharge and Discharge

Camp Pendleton reports the estimated safe yield for the San Mateo Basin at 3,180 AFY, the San Onofre Basin at 1,420 AFY, and the Las Flores Basin at 600 AFY.

### San Mateo Basin

Recharge is derived from percolation of runoff from rainfall through the natural reaches of San Mateo Creek. Effluent from Camp Pendleton Sewage Treatment Plant No. 12 is used for a seawater intrusion barrier.

### San Onofre Basin

Recharge is derived from percolation of runoff from rainfall through the natural reaches of San Onofre Creek. Effluent from Camp Pendleton Sewage Treatment Plant No. 11 is used for a seawater intrusion barrier.

### Las Flores Basin

Recharge is derived from percolation of runoff from rainfall through the natural reaches of Las Flores Creek. Effluent from Camp Pendleton Sewage Treatment Plant No. 9 is used for a seawater intrusion barrier.

## GROUNDWATER MANAGEMENT

None of the basins are managed and interactions with adjoining basins are not fully understood.

## WATER SUPPLY FACILITIES AND OPERATIONS

The following section provides a summary of facilities within the North San Diego County Basins.

### Active Production Wells

Groundwater from the San Mateo and San Onofre Basins supplies the northern portion of Camp Pendleton. Groundwater from the Las Flores Basin (and the Santa Margarita River system) provides the source of supply to the southern portion of Camp Pendleton. Camp Pendleton has four potable water supply wells in the San Mateo Basin, three potable water supply wells in the San Onofre Basin and three potable water supply wells in the Las Flores Basin. Reported average groundwater production (1985 through 2004) from these basins, as provided by Camp Pendleton, is shown in **Table 21-2**.

### Other Production

There are no data related to other production.

### ASR Wells

There are no ASR wells in the North San Diego County Basins.

**Spreading Basins**

There are spreading basins in the San Mateo Basin and the San Onofre Basin, but these spreading basins are used only for spreading treated wastewater effluent for seawater intrusion barriers for each of these groundwater basins. This is discussed below.

**Table 21-2**
**Summary of Production in the North San Diego County Basins**

| Basin | Number of Wells (Potable) | Average Production (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|
| San Mateo | 4 | 2,000 | Data not available |
| San Onofre | 3 | 500 | |
| Las Flores | 3 | 400 | |
| **Total** | **10** | **2,900** | |

Source: Camp Pendleton, 2006

**Seawater Intrusion Barriers**

There are seawater intrusion barriers in San Mateo Basin, San Onofre Basin and Las Flores Basin. These are described as follows.

**San Mateo Basin**

In the San Mateo Basin, wastewater is treated to Title 22 standards at Camp Pendleton Sewage Treatment Plant No. 12 and the effluent is delivered to percolation ponds near Interstate 5 to maintain a seawater intrusion barrier for the basin. This operation takes place down gradient from all potable water production wells.

**San Onofre Basin**

In the San Onofre Basin, wastewater is treated to Title 22 standards at Camp Pendleton Sewage Treatment Plant No. 10 and the effluent is delivered to percolation ponds near the coast to maintain a seawater intrusion barrier for the basin. This operation takes place down gradient from all potable water productions wells.

**Las Flores Basin**

In the Las Flores Basin, wastewater is treated to Title 22 standards at Camp Pendleton Sewage Treatment Plan No. 9 and the effluent is delivered to six injection wells at the coast along Red Beach to maintain a seawater intrusion barrier for the basin. This operation takes place down gradient from all potable water production wells.

### Desalters

There are no desalters in the North San Diego County Basins.

## GROUNDWATER LEVELS

### San Mateo Basin

According to DWR, groundwater level information is available until about 1988 with hydrographs showing that water levels vary with wet and dry weather cycles, generally recovering during wet periods. A hydrograph for a well in Christianitos Canyon ranges from 2 to 40 feet below ground surface during about 1965 through 1988. A hydrograph for one well at the confluence of Christianitos and San Mateo Creeks ranges from about 5 to 40 feet below ground surface during 1955 through 1988. Hydrographs for wells in the western part of the basin show small fluctuations about a stable level during 1946 through 1988.

### San Onofre Basin

According to DWR (2004), groundwater level information is available until about 1988 with hydrographs showing that water levels vary with wet and dry weather cycles, generally recovering during wet periods. In the upper part of the San Onofre Valley, a hydrograph for one well shows declines of 25 to 35 feet per dry cycle, but overall long-term stable behavior. In the lower San Onofre Valley, hydrographs show water levels generally rising from 4 to 12 feet during the 1950s through 1980s.

### Las Flores Basin

Water level data are not available for the Las Flores Basin.

## GROUNDWATER QUALITY

The following section describes the groundwater quality issues in the North San Diego County Basins. It includes a discussion of the monitoring programs and constituents of concern.

### Groundwater Quality Monitoring

The basin water quality assessments use Title 22 reporting for production wells.

### Groundwater Contaminants

The main constituent of concern in North San Diego County Basins is TDS, as shown in **Table 21-3**.

### Blending Needs

Data regarding blending needs are not available.

### Groundwater Treatment

Data regarding groundwater treatment are not available.

**Table 21-3**
**Summary of Constituents of Concern in the North San Diego County Basins**

| Basin | Constituent | Units | Range | Description |
|---|---|---|---|---|
| San Mateo Basin | **TDS** Secondary MCL = 500 | mg/L | 400 to 700 | Suitable for domestic and irrigation uses. |
| San Onofre Basin | **TDS** Secondary MCL = 500 | mg/L | 300 to 800 | Generally suitable for both domestic and irrigation uses, though groundwater in alluvium may be rated marginal for irrigation locally. |
| Las Flores Basin | **TDS** Secondary MCL = 500 | mg/L | 600 to 900 | Generally suitable for both domestic and irrigation uses |

Sources: SDCWA, 1997; DWR, 2003 and 2004, Camp Pendleton, 2006

## CURRENT GROUNDWATER STORAGE PROGRAMS

There are no groundwater storage agreements in the basins.

In 1997, Camp Pendleton and the former Tri-Cities Water District in southern Orange County were evaluating the potential for additional groundwater development within the San Mateo Basin. The former Tri-Cities Water District is now identified as the "Joint Regional Water Supply System" or JWRSS under a Joint Powers Authority (JPA), with South Coast Water District accepting the responsibility for operations and maintenance of the JWRSS. One project under study would have involved connecting the Camp Pendleton and former Tri-Cities water systems, and constructing wells as a source of emergency supply. A second proposal under study was a conjunctive use program to develop up to 2,000 AF of additional potable supply.

Stetson Engineers completed a study of potential groundwater management scenarios in the San Mateo and San Onofre Basins. Scenarios included sustained basin yield pumping and development of conjunctive use elements consistent with use of water from the Santa Margarita River Basin. The study included examination of a water exchange with Orange County, with construction of a pipeline from the wells in the San Mateo Basin to a South Coast Water District pipeline in Orange County, with water provided to Orange County in exchange for a similar amount of water provided to the city of Fallbrook through the San Diego Aqueduct.

**BASIN MANAGEMENT CONSIDERATIONS**

- High TDS levels, in particular in the San Onofre Basin, influence the suitability of groundwater for potable water use.
- Camp Pendleton and the former Tri-Cities Water District studied a potential conjunctive use program. If a similar program were pursued by the JWRSS (the former Tri-Cities Water District system operated by the South Coast Water District), an institutional agreement would need to be developed by the two agencies.

**References:**

California Department of Water Resources (DWR), 2003. California's Groundwater Bulletin 118 – San Mateo Valley Groundwater Basin. Updated 10/1/03. Website: http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/pdfs_desc/9-2.pdf Accessed 7/10/07.

California Department of Water Resources (DWR), 2004. California's Groundwater Bulletin 118 – San Onofre Valley Groundwater Basin. Updated 2/27/04. Website: http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/pdfs_desc/9-3.pdf Accessed 7/10/07.

Project Clean Water, 2006. Accessed at: http://www.projectcleanwater.org/html/ws_san_juan.html

San Diego County Water Authority (SDCWA), 1997. Groundwater Report.

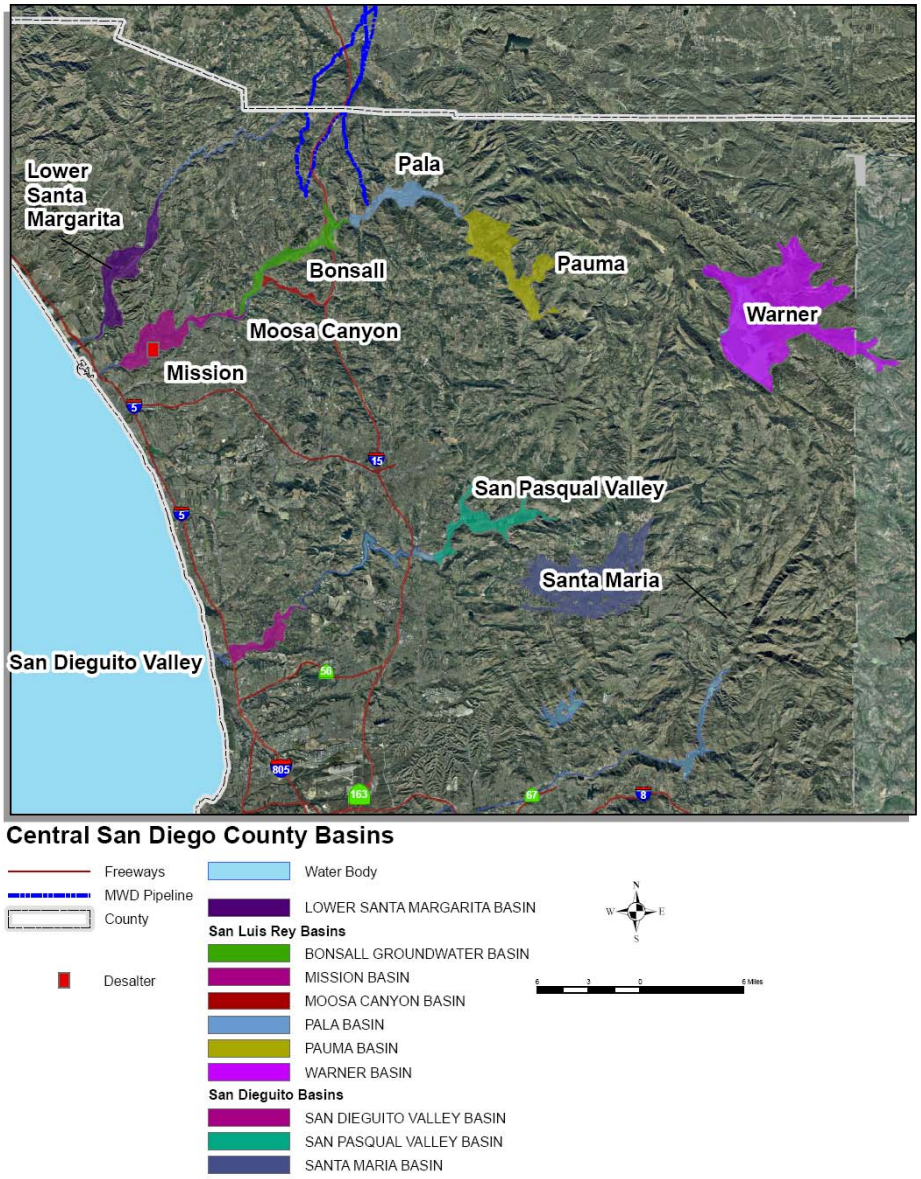
South Coast Water District (accepted responsibility for operations and maintenance of the former Tri-Cities Municipal Water District). Accessed at: http://www.scwd.org/about/about.htm#contract

United States Bureau of Reclamation and Stetson Engineers, Inc. 2005. Santa Margarita River Conjunctive Use Project, Pre-Feasibility Plan Formulation Study, San Diego County, California.

United States Marine Corps Base at Camp Pendleton. 2006. Comments on initial draft.

The groundwater basins in central San Diego County discussed in this section include: Lower Santa Margarita River Basin (Upper Ysidora Basin, Chappo Basin, and Lower Ysidora Basin), San Luis Rey River Valley Basins (Mission Basin, Bonsall Basin, Moosa Canyon Basin, Pala Basin, Pauma Basin, and Warner Basin), and the San Dieguito River Basins (San Dieguito Valley Basin, San Pasqual Valley Basin and Santa Maria Basin). The Central San Diego County Basins underlie the service area of the San Diego County Water Authority (SDCWA). A map of the Central San Diego County Basins is presented in **Figure 22-1**.

**Figure 22-1**
**Map of the Central San Diego County Basins**




Source: SDCWA

## BASIN CHARACTERIZATION

The following section provides a physical description of the Lower Santa Margarita River Basins, the San Luis Rey River Valley Basins, and the San Dieguito River Basins, including their geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

**Table 22-1** provides a summary of hydrogeologic parameters of the South San Diego Basins. Each basin is discussed separately in the following section. **Table 22-2** provides a summary of the storage and yield parameters for each of the basins in the Central San Diego County area.

**Table 22-1**
**Summary of Hydrogeologic Parameters for Central San Diego County Basins**

| Parameter | Lower Santa Margarita River Basins | San Luis Rey River Valley Basins | San Dieguito River Basins |
|---|---|---|---|
| Aquifer(s) | Unconfined to semi-confined alluvium | Unconfined to semi-confined alluvium | Unconfined to semi-confined alluvium |
| Depth of groundwater basin | 30 to 200 feet | Mission Basin<br>Up to 220 feet<br>Bonsall Basin<br>Up to 130 feet<br>Pala/Pauma Basin<br>Up to 240 feet<br>Moosa Canyon Basin<br>Up to 150 feet<br>Warner Basin<br>> 900 feet | San Dieguito Valley Basin<br>Up to 150 feet<br>San Pasqual Valley Basin<br>Up to 200 feet<br>Santa Maria Basin<br>Up to 225 feet |
| Thickness of water-bearing units | 30 to 200 feet | Data not available | Data not available |

Source: Camp Pendleton, 2006; City of San Diego, 2006; SDCWA, 1997

#### Lower Santa Margarita River Basins

The Santa Margarita River basin consists of 744 square miles of drainage area in both San Diego and Riverside Counties. The Santa Margarita River basin may be separated into the "Upper Basin" and the "Lower Basin." The Upper Basin is located in Riverside County and is controlled by the drainage of Temecula and Murrieta Creeks. The Lower Basin is controlled by the 27-mile long Santa Margarita River and contains major tributaries such as De Luz, Sandia, and Fallbrook Creeks. The entire Lower Basin has a drainage area of approximately 154 square miles.

Groundwater is found in the alluvial basin located downstream from the confluence of the Santa Margarita River and De Luz Creek and, to a lesser extent, in the shallow alluvium upstream of that confluence. The water-bearing unit within the basin is Quaternary age alluvial deposits, which consist of unconsolidated gravel, sand, silt and clay, which are 150 to 200 feet thick. Well yields in the basin range from 200 to 1,980 gpm. Groundwater is unconfined in the eastern portion and semi-confined in the western portion of the basin. Groundwater is also extracted from residuum and fractured bedrock beneath the basin.

**Table 22-2**
**Summary of Storage and Yield for the Central San Diego County Basins**

| Parameter | Lower Santa Margarita River Basins | San Luis Rey River Valley Basins | San Dieguito River Basins |
|---|---|---|---|
| Natural Safe Yield | 5,400 to 16,700 AFY | Mission Basin<br>7,000 to 10,000 AFY<br>Bonsall Basin<br>5,400 AFY<br>Pala/Pauma Basin<br>8,000 AFY<br>Moosa Canyon Basin<br>Data not available<br>Warner Basin<br>12,000 AFY | San Dieguito Valley Basin<br><2,500 AFY<br>San Pasqual Valley Basin<br>5,800 AFY<br>Santa Maria Basin<br>>2,500 AFY |
| Total Storage | 48,100 to 69,200 AF | Mission Basin:<br>92,000 AF<br>Bonsall Basin<br>25,000 to 40,000 AF<br>Pala/Pauma Basin<br>50,000 to 75,000 AF<br>Moosa Canyon Basin<br>4,000 AF<br>Warner Basin<br>550,000 AF | San Dieguito Valley Basin<br>50,000 AF<br>San Pasqual Valley Basin<br>58,000 AF<br>Santa Maria Basin<br>36,000 AF |
| Unused Storage Space | Negligible | Mission Basin<br>9,000 AF<br>Other Basins<br>Unknown | Unknown |
| Portion of Unused Storage Available for Storage | Negligible | Unknown | |

Sources: Camp Pendleton, 2006; SDCWA, 1997; Vista Irrigation District, 2006; Santa Margarita River Watermaster, 2006; City of San Diego, 2006

SDCWA reports that the total storage capacity for the basin is 69,200 AF. The Santa Margarita River Watermaster reports that the total combined storage for the Lower Santa Margarita Groundwater Basin (including the Upper Ysidora, Chappo, and Lower Ysidora Basins) between the depths of 5 and 100 feet is 48,100 AF. However, much of the storage is below sea level. In 2004/05, useable groundwater in storage was computed for all three sub-basins to be 28,634 AF out of a total usable space of 28,700 AF (Santa Margarita River Watermaster, 2006), which suggests that the basin was nearly full. Because of shallow water levels (often less than 10 feet below ground surface) in this area, there is limited available storage space.

### San Luis Rey River Valley Basins

The San Luis Rey River watershed is located east of the City of Oceanside. The watershed includes Mission Basin, Bonsall Basin, Moosa Canyon Basin, Pala Basin, Pauma Basin and Warner Basin. The 558 square mile drainage is the largest hydrologic unit in the San Diego region. The watershed drains to the Pacific Ocean to the west and is bounded by the Moserate Mountains to the north, the Cleveland National Forest and Camp Pendleton to the northwest, and Escondido, San Diego, and other cities to the south. The basin is roughly 50 miles long by 16 miles wide, and is divided into two hydrologic units by Henshaw Dam. The areas above and below the dam encompass 206 and 354 square miles, respectively.

San Luis Rey River Valley Groundwater Basins underlie an east-west-trending alluvium-filled valley located along the western coast of San Diego County. The major hydrologic feature is the San Luis Rey River, which drains the valley overlying the basin. The basin is bounded on the east, northeast and southeast by the contact of alluvium with impermeable Mesozoic granitic and Pre-Cretaceous metamorphic rocks. In the northwest and southwest of the lower portion of the basin, alluvium is in contact with the semi-permeable Eocene marine deposits and Tertiary non-marine deposits. The basin is bounded on the west by the Pacific Ocean. The watershed includes Mission Basin, Bonsall Basin, Moosa Canyon Basin, Pala Basin, Pauma Basin and Warner Basin.

#### *Mission Basin*

The Mission Basin lies almost entirely within the limits of the City of Oceanside and extends upstream from the Pacific Ocean to just past Oceanside's eastern boundary and west of the Bonsall Bridge near the intersection of State Route (SR) 76 and SR 13. The basin is alluvial and unconfined in the central and eastern areas; while there is unconfined alluvium overlying semi-confined alluvium in the western areas. The volume of groundwater currently in storage within the alluvial aquifers (shallow and deep) in the Mission Basin is estimated to be 54,000 AF. The volume of unused storage within the alluvium (occurring between the water table-and the ground surface) was estimated to be 9,000 AF. The amount of this storage that is unusable has not been determined.

#### *Bonsall Basin*

The Bonsall Groundwater Basin is located east and upstream of the Mission Basin. It is generally located within unincorporated areas of San Diego County. The Bonsall Groundwater

Basin extends eastward from the Bonsall Bridge to a point approximately one mile west of the intersection of Rice Canyon Road and SR 76. The basin is alluvial and unconfined.

***Moosa Canyon Basin***

This basin is south and tributary to Bonsall Basin.

***Pala/Pauma Basins***

These are unconfined alluvial basins to the east of the Bonsall Basin.

***Warner Basin***

This groundwater basin underlies the Warner Valley and Valle de San Jose, the upper drainage of the San Luis Rey River in northeastern San Diego County. The basin is bounded on the west by Lake Henshaw and the Elsinore fault and on all other sides by impermeable crystalline rocks of the Peninsular Ranges.

The principal water bearing deposits within the San Luis Rey River Basins are Quaternary and younger alluvium. The most productive materials are the sands and gravels. Well yields can exceed 2,000 gpm and average 500 gpm. Thickness of these deposits varies in the basin with an average thickness of 200 feet.

**San Dieguito River Basins**

The San Dieguito River watershed is a drainage area of approximately 346 square miles that includes portions of the cities of Del Mar, Escondido, Poway, San Diego, and Solana Beach, and unincorporated San Diego County. The watershed includes the San Dieguito Valley Basin, the San Pasqual Valley Basin, and the Santa Maria Basin.

***San Dieguito Valley Basin***

The San Dieguito Valley Basin is an alluvial groundwater basin that occupies the Lower San Dieguito River Valley west of Lake Hodges, and extends inland approximately six miles from the Pacific Ocean. The basin underlies the cities of Del Mar, Solana Beach and San Diego, and the County of San Diego. In the past, the basin provided a local source of water for both agricultural and domestic activities. However, the construction of Lake Hodges Dam significantly reduced natural recharge to the groundwater basin. Lake Hodges is a 33,550 AF reservoir owned and operated by the city of San Diego. This, coupled with periodic drought and increased local pumping has, in the past, resulted in an extreme lowering of the groundwater table, seawater intrusion, and increased salinity levels in the groundwater. The San Dieguito Valley basin is estimated to have a storage capacity of 50,000. It is unclear how much groundwater is currently in storage.

***San Pasqual Valley Basin***

The San Pasqual Basin is located in the northern portion of the City of San Diego, along the San Dieguito River upstream of Lake Hodges, between the City of Escondido to the north and the Community of Rancho Bernardo and the City of Poway to the south. The City of San Diego reports that the San Pasqual Basin is unconfined and that the basin surface area is approximately 5,064 acres. According to DWR, the groundwater basin underlies the San Pasqual Valley and the Cloverdale, Rockwood and Bandy Canyons. The basin is bounded by Lake Hodges on the west and otherwise nonwater-bearing rocks of the Peninsular Ranges. Metcalf & Eddy notes that the most common estimate for total groundwater storage capacity is 58,000 AF.

The majority of the San Pasqual Basin is owned and managed by the City of San Diego Water Department. Additionally, the City of San Diego owns the rights to the underlying groundwater basin. As a designated agricultural preserve, the San Pasqual Valley is sparsely populated. The San Diego Wild Animal Park operates in the valley through a lease agreement with the city.

***Santa Maria Basin***

The Santa Maria Basin underlies the Santa Maria Valley in central San Diego County. The basin is bounded by impermeable crystalline rocks. The valley is drained by Santa Maria Creek, a tributary to San Dieguito River. Total storage capacity of the basin is estimated to be 77,000 AF. Storage capacity for the alluvium is estimated at about 3,360 AF and for the residuum (bedrock that has weathered in place) is about 32,400 AF for a total storage capacity of 36,000 AF.

**Safe Yield/Long-Term Balance of Recharge and Discharge**

Central San Diego County is relatively dry with average precipitation of 9.09 inches per year. **Figure 22-2** presents the historical precipitation from the Oceanside Marina. Extremely dry years occurred in 1989, 1994, 1999, and 2002. Fairly wet years occurred in 1993 and 1998. Primary sources of recharge in these basins are from surface water infiltration in the river bottoms.

**Lower Santa Margarita River Basins**

As shown in **Table 22-2**, the safe yield of the Lower Santa Margarita River Basins is estimated at 5,400 to 16,700 AFY (Camp Pendleton, 2006).

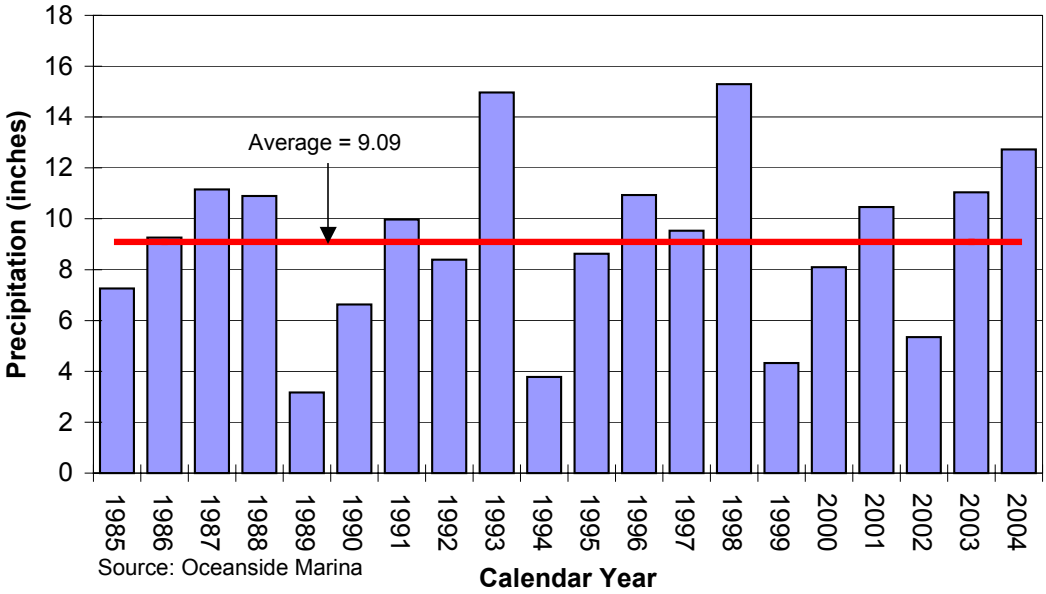
**San Luis Rey River Valley Basins**

The San Luis Rey Valley groundwater basins are recharged by imported irrigation water applied on upland areas and by storm-flow in the San Luis Rey River and its tributaries. Movement of groundwater in the alluvial aquifer is westward towards the Pacific Ocean. The estimated sustainable yield of the San Luis Rey River Basins without groundwater management totals is estimated to be approximately 25,400 AFY to 38,400 AFY.

### San Dieguito River Basins

The estimated sustainable yield of the San Dieguito River Basins without groundwater management is presented in **Table 22-2**. Estimates of safe yield range from 14,230 to 17,310 AFY for the San Dieguito River Basins.

**Figure 22-2**
**Historical Precipitation in the Central San Diego County**




## GROUNDWATER MANAGEMENT

The following section describes how the Lower Santa Margarita River Basin, the San Luis Rey River Basins, and the San Dieguito River Basins are currently managed.

### Basin Governance

The following describes the management structure within the Lower Santa Margarita River Basins, the San Luis Rey River Basins, and the San Dieguito River Basins. A summary of the management agencies in the Central San Diego County Basins is shown in **Table 22-3**.

### Lower Santa Margarita River Basins

The Lower Santa Margarita River Basins are adjudicated. The basin constraints and limitations are related to various state permits, rights, and licenses. There are various federal and state court judgments and decisions, as well as pre-1914 water rights. Also, there are pending lawsuits in state and federal courts concerning water rights and stream flows in the Santa Margarita River watershed.

**Table 22-3**
**Summary of Management Agencies in the Central San Diego County Basins**

| Agency | Role |
|---|---|
| **Lower Santa Margarita River Basins** | |
| Santa Margarita River Watershed Watermaster | Court-appointed Watermaster for oversight and administration of water rights |
| Santa Margarita River Watershed Watermaster Steering Committee | Assist the Court and Watermaster in administering the water rights |
| Camp Pendleton | Operation of recharge facilities and Red Beach seawater barrier. |
| **San Luis Rey River Basins** | |
| San Luis Rey Watershed Council | Develop and implement a comprehensive resource management plan for the San Luis Rey River and its tributaries |
| **San Dieguito River Basins** | |
| San Dieguito Basin Task Force | Evaluating the feasibility of groundwater management and a 4,000 to 8,000 AFY conjunctive use project in the lower San Dieguito basin. |
| City of San Diego | AB3030 Groundwater Management Plan in San Pasqual Basin will be considered for adoption in September 2007. Evaluating the feasibility of 10,000 AFY of conjunctive use in San Pasqual Basin. Evaluating the feasibility of 5,000 AFY of brackish desalination facility in San Pasqual Basin. |

In March 1989, the Court appointed a Watermaster to administer and enforce the provisions of the Modified Final Judgment and Decree entered on April 6, 1966 by the U.S. District Court in the United States v. Fallbrook Utility District, et al. (Civil No. 1247-SD-T) and subsequent orders of the Court. Also in 1989, the Court also appointed a Steering Committee that is currently comprised of representatives from the United States, Eastern Municipal Water District (EMWD), Fallbrook Public Utility District, Metropolitan, the Pechanga Band of Luiseño

Indians, and Rancho California Water District (RCWD). The purposes of the Steering Committee are to assist the Court and the Watermaster in administering the water rights.

The United States Bureau of Reclamation (USBR) is currently conducting a study on a conjunctive use project that is to provide a "physical solution" to the Federal lawsuit between Camp Pendleton and Fallbrook Public Utilities District. The project will also provide an emergency delivery system for imported water to Camp Pendleton, while allowing Camp Pendleton to meet its domestic, agricultural, and military water needs.

#### San Luis Rey River Valley Basins

The San Luis Rey River Valley Basins are unadjudicated. There is no established governance structure regulating the groundwater basins within the San Luis Rey River watershed. There is the San Luis Rey Watershed Council – a partnership of local landowners, agricultural growers, Native American bands, community and environmental organizations, government agencies and special districts – whose primary goal is to develop and implement a comprehensive resource management plan for the San Luis Rey River and its tributaries. The Council developed the "San Luis Rey Watershed Management Guidelines" document in 2000, to serve as the foundation for current and future San Luis Rey River management efforts. Council members identified and prioritized important issues for the river and outlined recommended actions for improving the health of the watershed. These guidelines will be revised and updated periodically to reflect the needs of the watershed.

#### San Dieguito River Basins

The San Dieguito River Basins are unadjudicated. There is no established governance structure regulating the groundwater basins within the San Dieguito River watershed. The San Dieguito Basin Task Force (composed of nine water supply and wastewater agencies) is currently evaluating the feasibility of groundwater management and a 4,000 to 8,000 AFY conjunctive use project in the lower San Dieguito Basin. The city of San Diego is preparing a groundwater management plan for the San Pasqual Basin.

### Interactions with Adjoining Basins

There are no formal agreements governing flow between and among the Central San Diego County Basins.

## WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Lower Santa Margarita River Basins, the San Luis Rey River Valley Basins, and the San Dieguito River Basins. Facilities include groundwater production wells, 114 acres of spreading basins, a seawater intrusion barrier operated by Camp Pendleton and a desalter operated by the City of Oceanside.

**Active Production Wells**

The following provides a description of the existing active municipal production wells in the Central San Diego County Basins. Data are summarized in **Table 22-4**.

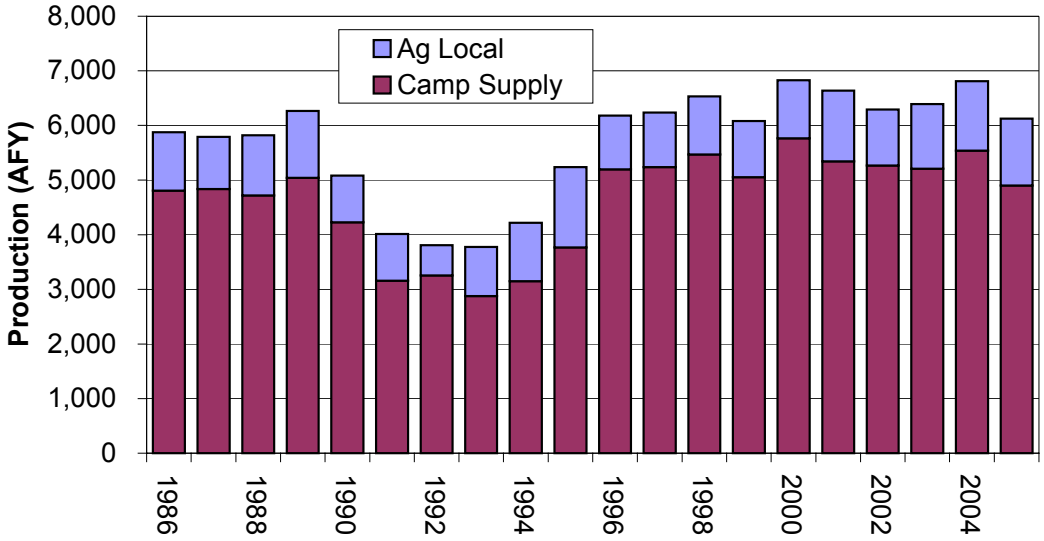
**Lower Santa Margarita River Basins**

According to Camp Pendleton, there are 15 wells in the Lower Santa Margarita River Basin, with 80 percent for domestic use and the remaining 20 percent of the production for agriculture.

The Santa Margarita River Watermaster reports the groundwater production for Camp Pendleton, as shown in **Figure 22-3**. This production excludes the adjacent Naval Weapons Station, which has received imported water from the Fallbrook Public Utility District since 1969.

Groundwater from the Upper Ysidora and Chappo Basins provides more than 90 percent of the supply of potable water for the southern portion of Camp Pendleton (groundwater outside the Lower Santa Margarita River Basin serves the northern portion of Camp Pendleton.). Camp Pendleton also uses groundwater from the Lower Ysidora Basin, primarily to irrigate agricultural lands leased to contracting agricultural businesses.

**Figure 22-3**
**Historical Groundwater Production in the Lower Santa Margarita River Basin**
**Camp Pendleton**




Source: Santa Margarita River Watermaster, 2006

**San Luis Rey River Valley Basins**

A summary of the principal use and the approximate annual use of groundwater by basin is shown in **Table 22-4**.

**Table 22-4**
**Summary of Production in Central San Diego County Basins**

| Category | Number of Wells | Estimated Production Capacity (AFY) | Average Production (AFY) | Well Operation Cost ($/AF) |
|---|---|---|---|---|
| **Lower Santa Margarita River Basins** | | Data not available | | Data not available |
| Municipal | 15 | | 5,800 | |
| Private | 0 | | | |
| **San Luis Rey River Valley Basins** | | | | |
| Mission Basin | Data not available | | | |
| • Municipal | | | 2,200 | |
| • Private | | | 2,000 | |
| Bonsall Basin | | | | |
| • Municipal | | | 0 | |
| • Private | | | 2,500 | |
| Pala/Pauma Basin | | | | |
| • Municipal | | | 2,700 | |
| • Private | | | 5,000 | |
| Moosa Canyon | | | Unknown | |
| Warner | | | | |
| • Municipal | | | 7,000 | |
| • Private | | | Unknown | |
| **San Dieguito River Basins** | | | | |
| San Dieguito Valley | | | 2,500 | |
| San Pasqual Valley | | | 4,000 | |
| Santa Maria | | | 250 | |

Sources: Camp Pendleton, 2006; SDCWA, 1997; Ramona Municipal Water District, Urban Water Management Plan, 2005; Vista Irrigation District, 2006; City of San Diego, 2006

### San Dieguito River Basins

There are no active municipal water wells in the San Dieguito Valley Basin. There are no existing municipal production wells in the San Pasqual Valley Basin. The Ramona Municipal Water District (RMWD) owns three wells in the Santa Maria Basin with a capacity of 330 gpm and a potential yield of 200 AFY. The RMWD wells are currently not used due to high nitrates and will require recertification to place back in service. However, local landowners are using groundwater extensively. A summary of the principal use and the approximate annual use of groundwater by basin in the San Dieguito River watershed is shown in **Table 22-4**.

### Other Production

There are an unknown number of private wells throughout the Central San Diego County Basins. Available production data are summarized in **Table 22-4**.

### ASR Wells

There are no ASR wells in the Central San Diego County Basins.

### Spreading Basins

There are approximately 65 acres of spreading basins in the Central San Diego County Basins.

### Lower Santa Margarita River Basins

A Camp Pendleton off-channel surface water spreading system, in operation since 1960, replenishes water pumped from the groundwater basins. This existing system consists of a steel sheet pile diversion weir constructed across the Santa Margarita River and an earthen channel to convey river diversions to a series of five interconnected groundwater recharge ponds and to Lake O'Neill. Lake O'Neill is a 1,680 AF reservoir located on Fallbrook Creek, a minor tributary to the Santa Margarita River. Most of the water stored in the lake is diverted from the nearby Santa Margarita River. Information on these spreading basins is shown in **Table 22-5**.

**Table 22-5**
**Summary of Spreading Basins in the Lower Santa Margarita River Basins**

| Recharge Basins | Area (acres) | Recharge Capacity (cfs) | Recharge Capacity (AFY) | Source Water | Owner |
|---|---|---|---|---|---|
| Pendleton Diversion Ponds | 45 | Data not available | 4,000 | River | Camp Pendleton |

Source: Camp Pendleton; USBR, Santa Margarita River Conjunctive Use Project, Pre-Feasibility Plan Formulation Study, 2005

#### San Luis Rey River Valley Basins

There are no spreading basins within the San Luis Rey River Valley Basins.

#### San Dieguito River Basins

There are no spreading basins in the San Dieguito River Basins.

### Seawater Intrusion Barriers

There is one seawater intrusion barrier in the Central San Diego County Basins. The details are discussed below.

#### Lower Santa Margarita River Basins

Camp Pendleton operates the Red Beach seawater barrier using recycled water. This barrier has six injection wells. Camp Pendleton reports that this barrier is in the process of being shut down with the effluent to be sent to a new tertiary treatment plant near the city of Oceanside.

#### San Luis Rey River Valley Basins

There are no seawater intrusion barriers in the San Luis Rey River Valley Basins.

#### San Dieguito River Basins

There are no seawater barriers in the San Dieguito River Basins.

### Desalters

There is one desalter in the Central San Diego County Basins. The details of this facility are described below.

#### Lower Santa Margarita River Basins

There are no desalters in the Lower Santa Margarita River Basins.

#### San Luis Rey River Valley Basins

The City of Oceanside's current local water supply source is the Mission Basin Groundwater Purification Facility (MBGPF) where brackish groundwater is extracted and desalted. The MBGPF is currently producing about 3 MGD, with a planned expansion to 6.37 MGD.

#### San Dieguito River Basins

There are no desalters in the San Dieguito River Basins.

## GROUNDWATER LEVELS

Groundwater in the Central San Diego Basins is generally shallow with depths to groundwater ranging from near the ground surface to about 100 feet. Limited water level data are available – available data for each basin is discussed below.

### Lower Santa Margarita River Basins

Camp Pendleton measures groundwater levels at four wells on a monthly basis. Depth to water ranges from 10 to 100 feet. Camp Pendleton reports that the basin is successfully operating within the prescribed range of management levels.

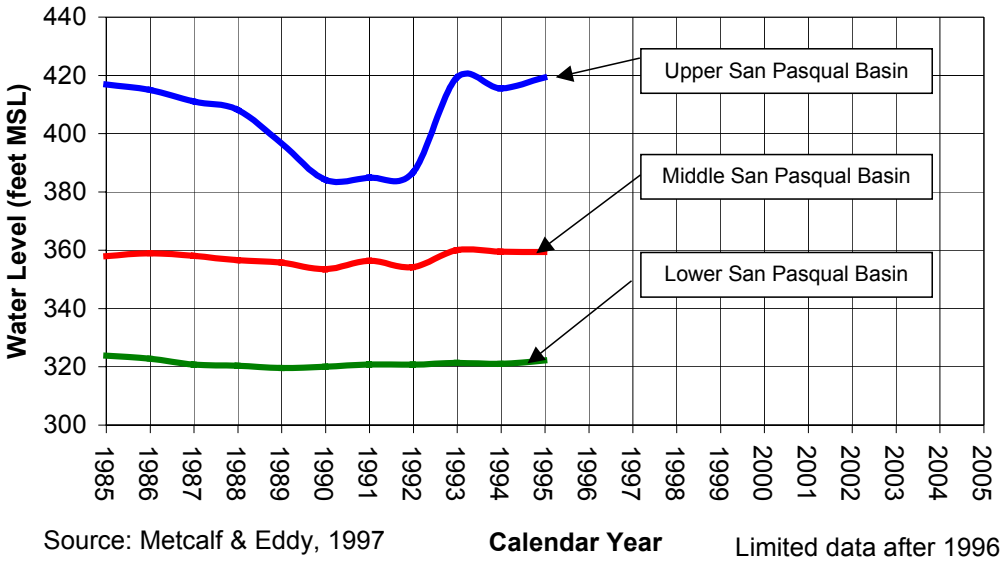
### San Luis Rey River Valley Basins

Water levels in the basin declined drastically in the 1950s and 1960s due to groundwater development and over pumping. Since the advent of imported water sources, groundwater levels have risen to near pre-development levels and averages range from zero to 20 feet below land surface.

### San Dieguito River Basins

The City of San Diego monitors the groundwater levels in nine wells in the San Pasqual Valley Basin. The historical groundwater levels for three of these wells are presented in **Figure 22-4**.

**Figure 22-4**
**Historical Water Levels in the San Pasqual Valley Basin**




Source: Metcalf & Eddy, 1997

## GROUNDWATER QUALITY

The following section describes the water quality issues in the Central San Diego County Basins.

### Groundwater Quality Monitoring

There is no formal groundwater quality-monitoring program for the Central San Diego County Basins. Wells are monitored as required under Title 22.

### Groundwater Contaminants

Constituents of concern in the Central San Diego Basins include: total dissolved solids (TDS), magnesium, sulfate, chloride, fluoride, iron, manganese and selenium. Other constituents of regional concern including nitrate, volatile organic compounds (VOCs) and perchlorate are also summarized in **Tables 22-6, 22-7 and 22-8**.

#### Lower Santa Margarita River Basins

Constituents of concern for the Lower Santa Margarita River Basin are summarized in **Table 22-6**. Groundwater in the northwestern part of the basin is largely suitable for domestic and irrigation uses. Groundwater in the southwestern part of the basin is marginal to inferior for domestic and irrigation uses. Magnesium, sulfate, chloride, nitrate, and TDS concentrations are locally high for domestic use; whereas, chloride, boron, and TDS concentrations are locally high for irrigation use.

#### San Luis Rey River Valley Basins

Constituents of concern in the San Luis Rey River Valley Basins are shown in **Table 22-7**.

#### San Dieguito River Basins

Constituents of concern in the San Dieguito River basins are presented in **Table 22-8**.

### Blending Needs

Data regarding blending needs are not available for the Central San Diego County Basins.

### Groundwater Treatment

The following describes the groundwater treatment activities in the Central San Diego County Basins.

#### Lower Santa Margarita River Basins

Camp Pendleton operates iron and manganese treatment plants treating the groundwater used for municipal uses.

**Table 22-6**
**Summary of Constituents of Concern in the Lower Santa Margarita River Basins**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL = 500 | mg/L | 325 to 1,260 | In 1956, TDS concentrations ranged as high as 337 to 9,030 mg/l. |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/L | 0.1 to 8 | Meets drinking water standards |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL for TCE = 5<br>Primary MCL for PCE = 5 | µg/L | Data not available | Data not available |
| **Perchlorate**<br>Notification level = 6 | µg/L | ND | Perchlorate not detected |
| **Magnesium**<br>No MCL | mg/L | 23 to 39 | Magnesium, sulfate, chloride, nitrate, and TDS concentrations are locally high for domestic use; whereas, chloride, boron, and TDS concentrations are locally high for irrigation use. |
| **Sulfate**<br>Secondary MCL = 250 | mg/L | 100 to 400 | |
| **Chloride**<br>Secondary MCL = 250 | mg/L | 10 to 335 | |
| **Fluoride**<br>Primary MCL = 2 | mg/L | 0.11 to 6.4 | |

Source: USBR, 2005

**Table 22-7**
**Summary of Constituents of Concern in San Luis Rey River Valley Basins**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL = 500 | mg/l | 168 to 3,400 | TDS concentrations in the Mission Basin range from 500 to 2,000 mg/l. TDS concentrations in Bonsall Basin range from 600 to 3,400 mg/l. In Pala/Pauma Basins, TDS ranges from 200 to 900 mg/l. For Moosa Canyon Basin, TDS ranges from 650 to 1,380 mg/l. TDS in Warner Basin ranges from 168 to 638 mg/l. |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/l | Data not available | May not comply with Drinking Water Standards in Pala/Pauma Basins. |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL for TCE = 5<br>Primary MCL for PCE = 5 | µg/L | Data not available | Data not available |
| **Perchlorate**<br>Notification level = 6 | µg/L | ND | Perchlorate not detected |
| **Iron**<br>Secondary MCL = 0.3 | mg/l | Data not available | May not comply with Drinking Water Standards in Mission Basin. |
| **Manganese**<br>Secondary MCL = 0.05 | mg/l | Data not available | May not comply with Drinking Water Standards in Mission Basin. |

Source: SDCWA 1997

**Table 22-8**
**Summary of Constituents of Concern in the San Dieguito River Basins**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL = 500 | mg/L | 320 to 27,000 | TDS concentrations in the lower portions of the San Dieguito Basin range from 1,000 to 27,000 mg/l. In the San Pasqual Basin, TDS ranges from 600 to 2,500 mg/L. TDS concentrations in Santa Maria Basin range from 320 to 1,680 mg/L. |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/L | 0.2 to 385 | Nitrate found in Santa Maria Basin wells owned by Ramona Municipal Water District (RMWD) forced shutdown of wells. Nitrate found in San Pasqual Valley Basin. |
| **VOCs**<br>**(TCE and PCE)**<br>Primary MCL for TCE = 5<br>Primary MCL for PCE = 5 | µg/L | Data not available | Data not available |
| **Perchlorate**<br>Notification level = 6 | µg/L | ND | Perchlorate not detected |
| **Selenium**<br>Primary MCL = 50 | mg/L | Data not available | Selenium found in Santa Maria basin wells owned by RMWD forced shutdown of wells. |

Source: SDCWA, 1997; City of San Diego, 2006

### San Luis Rey River Valley Basins

As described above, the city of Oceanside currently operates its Mission Basin Groundwater Purification Facility (MBGPF) that uses a reverse osmosis treatment process for desalination and for removal of iron and manganese. Oceanside is in the process of expanding the facility from three MGD to 6.37 MGD.

### San Dieguito River Basins

Groundwater is not treated in the San Dieguito River Basins.

## CURRENT GROUNDWATER STORAGE PROGRAMS

The following describes the current groundwater storage programs in the Central San Diego County Basins.

### Lower Santa Margarita River Basins

There are no groundwater storage agreements in the Lower Santa Margarita River Basins.

### San Luis Rey River Valley Basins

There are currently no groundwater storage programs within the San Luis Rey groundwater basins. The Final Lower San Luis Rey River Valley Groundwater Storage and Recovery Feasibility Study (March 2005) completed for SDCWA identified the potential use of groundwater storage for the City of Oceanside, Carlsbad MWD, and Rainbow MWD.

### San Dieguito River Basins

There are no groundwater storage agreements in the San Dieguito River Basins.

## BASIN MANAGEMENT CONSIDERATIONS

The following provides a brief description of the basin management considerations.

### Lower Santa Margarita River Basins

- The basin has high levels of iron and manganese requiring treatment for potable use. According to Camp Pendleton, the base pumps only the amount needed to satisfy demand and facility needs have been factored into the estimate of useable storage capacity.

### San Luis Rey River Valley Basins

- High TDS levels are found in the groundwater of all the basins, with lower groundwater TDS values found in certain areas of some of the basins allowing for domestic use. Still, many locations may require desalination treatment prior to use as a domestic water supply. The City of Oceanside operates a groundwater desalination facility (Mission Basin Groundwater Purification Facility.)

- Recharge is primarily limited to streambeds as there are no spreading basins. It is unclear if basins could be readily replenished, through natural or artificial means to allow increased pumping under conjunctive use programs.

### San Dieguito River Basins

- There are high TDS levels in all three basins and high nitrate and selenium levels in the Santa Maria Basin that limit municipal use without some form of treatment.

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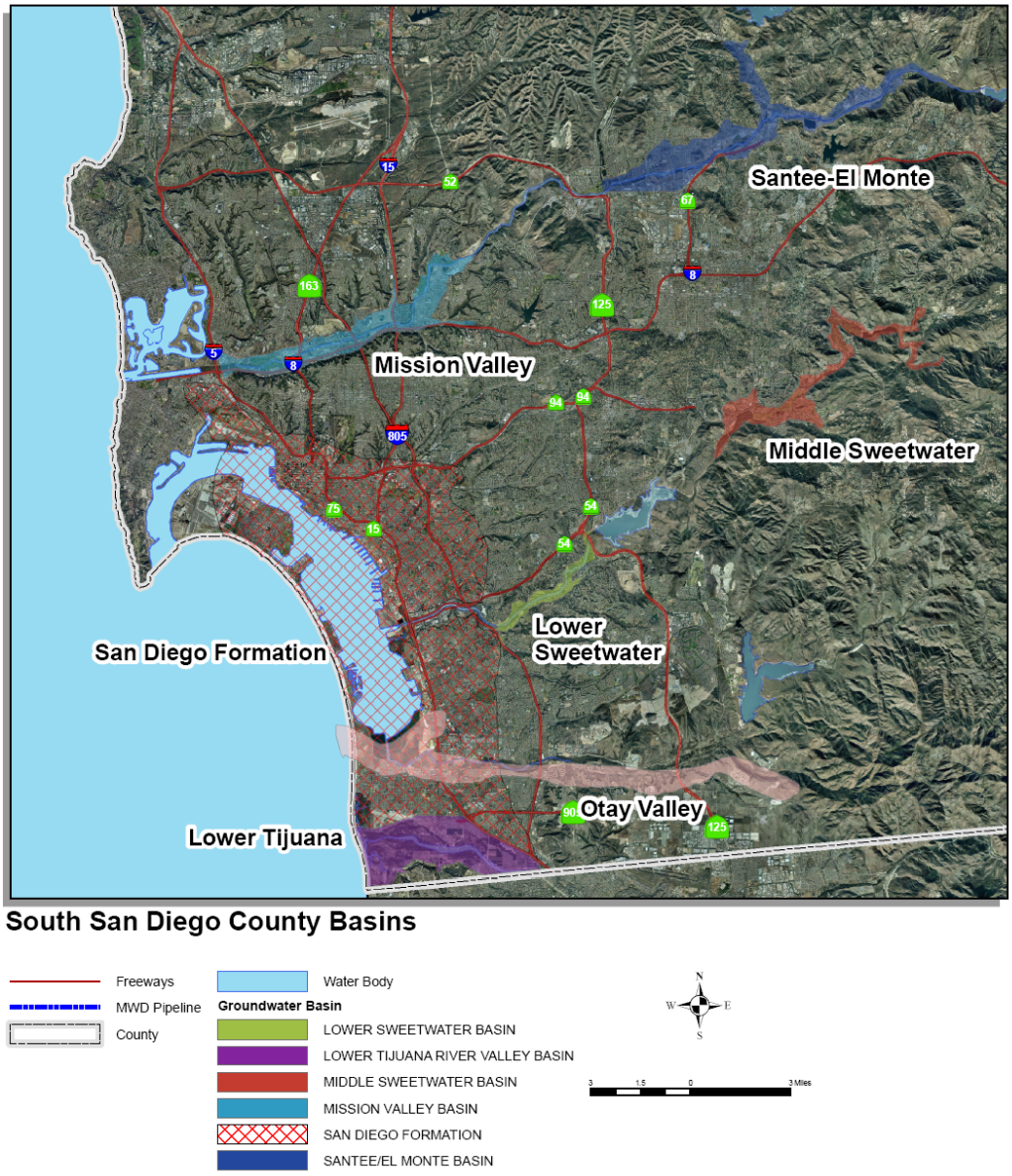
The groundwater basins in south San Diego County discussed in this section include: Lower Sweetwater Basin, Middle Sweetwater Basin, San Diego Formation, Santee-El Monte Basin, Mission Valley Basin, Otay Valley Basin, and Lower Tijuana River Valley Basin. Because available data are limited for several of the smaller basins, basin descriptions are combined where applicable. The South San Diego County Basins underlie the service area of the San Diego County Water Authority (SDCWA). A map of the South San Diego County Basins is presented in **Figure 23-1**.

**Figure 23-1**
**Map of the South San Diego County Basins**




Source: SDCWA

## BASIN CHARACTERIZATION

The following section provides a physical description of the Sweetwater Basins, the San Diego Formation, and the Santee-El Monte Basin including its geographic location and hydrogeologic character.

### Basin Producing Zones and Storage Capacity

**Table 23-1** provides a summary of hydrogeologic parameters of the South San Diego County Basins. Each basin is discussed separately in the following section.

#### Sweetwater Basins-San Diego Formation

The Sweetwater Basins underlie an alluvial valley of the Sweetwater River that empties into the San Diego Bay near the cities of National City and Chula Vista. The basins include the Lower Sweetwater Basin and the Middle Sweetwater Basin. The San Diego Formation is part of a thick wedge of sediments that was deposited along the coast in the San Diego Bay area in southwestern San Diego County. The San Diego Formation is believed to be at least 1,000 feet thick in an area that underlies the cities of Imperial Beach, Chula Vista, and National City, and southern portions of the city of San Diego.

The Sweetwater Basins within the alluvial plain of the Sweetwater River are unconfined. The San Diego Formation is confined, with a basin ground surface area of 79,724 acres. San Diego County Water Authority estimates a groundwater storage capacity of 13,000 AF in the Lower Sweetwater Basin, 28,900 AF in the Middle Sweetwater Basin, and about 960,000 AF in the San Diego Formation. These values suggest a total storage capacity of about 973,000 AF for the Sweetwater Basins-San Diego Formation. DWR (1986) estimated that between 17,000 and 20,000 AF of groundwater was in storage. Based upon current understanding of the hydrogeology of the San Diego Formation, the usable and more cost-effective storage in the formation has been approximated to be on the order of 40,000 to 90,000 AFY.

#### Santee-El Monte Basin

The Santee-El Monte Basin is an unconfined groundwater basin located in the eastern portion of the San Diego River watershed near the cities of Santee, La Mesa, El Cajon, and Lemon Grove. The groundwater basin is comprised of commingling alluvial valleys of the San Diego River, San Vicente Creek, Forester Creek, Los Coches Creek, and Sycamore Canyon Creek.

The alluvial aquifer ranges in thickness up to 230 feet or more and is thickest in the eastern portion of the basin. In Santee, the alluvium thickness is limited, ranging from less than 10 feet to approximately 30 feet. According to Helix Water District (Helix WD), a water purveyor in the basin, numerous studies have been performed on the El Monte Basin with estimates of total storage capacity ranging from 18,000 to 50,000 AF. Other reports suggest a range from 70,000 to 97,000 AFY (Anchor Environmental, 2004). The basin yield during a drought period, with an initially full basin, was modeled to be approximately 24,000 AF.

**Table 23-1**
**Summary of Hydrogeologic Parameters for South San Diego County Basins**

| Parameter | Sweetwater Basins and San Diego Formation | Santee-El Monte Basin | Other South San Diego County Basins |
|---|---|---|---|
| **Structure** | | | |
| Aquifer(s) | Sweetwater Basins Unconfined<br>San Diego Formation Confined | Unconfined | Unconfined |
| Depth of groundwater basin | Up to 1,200 feet | Up to 405 feet | Data not available |
| Thickness of water-bearing units | Data not available | 10 to 230 feet | |
| **Yield and Storage** | | | |
| Natural Safe Yield | Lower Sweetwater 2,400 AFY<br>Middle Sweetwater 3,000 AFY<br>San Diego Formation 3,000 to 5,000 AFY | 3,000 to 4,000 AFY | Mission Valley 2,000 to 4,000 AFY<br>Lower Tijuana River 5,000 to 6,800 AFY<br>Otay Valley Unknown |
| Total Storage | Lower Sweetwater 13,000 AF<br>Middle Sweetwater 28,900AF<br>San Diego Formation 960,000 AF | 18,000 to 57,000 AF | Mission Valley 40,000 to 42,000 AF<br>Lower Tijuana River 50,000 to 80,000 AF<br>Otay Valley Unknown |
| Unused Storage Space | Unknown | 20,000 AF | Unknown |
| Portion of Unused Storage Available for Storage | Unknown | 18,860 AF | |

Source: Helix Water District, 2006; Sweetwater Authority, 2006; City of San Diego, 2006

Historically, agricultural users have been the greatest private consumers of groundwater in the basin. Since 1960, groundwater use in the basin has declined. A major reason for the decline in groundwater use is the shift in land use from predominantly agricultural and rural residential to urban land use, particularly in Santee and Lakeside and as water agencies began distributing imported water.

### Other South San Diego County Basins

There are three other alluvial basins in the south county region: Mission Valley Basin, Otay Valley Basin, and the Lower Tijuana River Valley Basin that are smaller, with less groundwater development potential. Limited data are available for these basins.

The Mission Valley underlies an east-west trending valley, which is drained by the San Diego River to Mission Bay in the city of San Diego. Storage capacity estimates range from 40,000 to 42,000 AF (DWR, 2004).

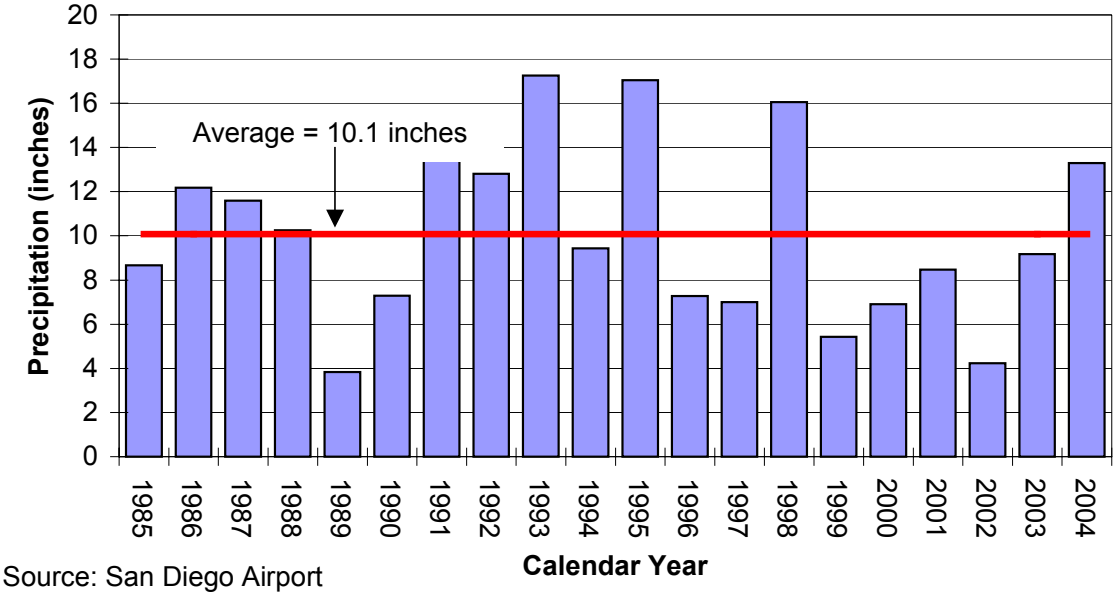
The Otay Valley is adjacent to the Pacific coast in southwestern San Diego County along the Otay River. Storage capacity is unknown.

The Lower Tijuana River Valley underlies the Tijuana River along the California-Mexico Border. Storage capacity is unknown.

### Safe Yield/Long-Term Balance of Recharge and Discharge

South San Diego County is relatively dry with average precipitation of 10.1 inches per year. **Figure 23-2** presents the historical precipitation data from San Diego Weather Service Office (WSO) at Lindbergh Field. These data suggest below average precipitation in 1985, 1989, 1990, 1996, 1997, and the period from 1999 to 2003. Above average precipitation occurred in 1986, 1987, 1991 to 1993, 1995, 1998, and 2004.

**Figure 23-2**
**Historical Precipitation in the South San Diego County Basins**




Source: San Diego Airport

### Sweetwater Basins-San Diego Formation

SDCWA reports the safe yield of the Lower Sweetwater Basin at 2,400 AFY, the Middle Sweetwater Basin at 3,000 AFY, and the San Diego Formation at 3,000-5,000 AFY.

### Santee-El Monte Basin

The primary source of recharge to the Santee-El Monte Basin is infiltration from the San Diego River. Recharge to the alluvial aquifer is greatest in the eastern portion of the basin where precipitation is greater and runoff is generated on the steep bedrock slopes adjacent to the river valley. Based on water level trends, it was concluded that recharge occurs infrequently, during only the wettest periods. The most significant recharge only occurs in response to large spills from El Capitan and San Vicente Reservoirs. Numerous studies have been performed on the safe yield for the Santee-El Monte Basin. Estimates of safe yield range from 3,000 to 4,000 AFY.

### Other South San Diego County Basins

The city of San Diego reports that the safe yield of the Mission Valley Basin is estimated at 2,000 to 4,000 AFY. Additionally, the city reports that the safe yield of the Lower Tijuana River Valley Basin is estimated at 5,000 to 6,800 AFY. Information was not available on the safe yield for the Otay Valley Basin.

## GROUNDWATER MANAGEMENT

The following section describes the status of groundwater management in the Sweetwater Basins, the San Diego Formation and the Santee-El Monte Basin, and the smaller basins of Mission Valley, Otay Valley and Lower Tijuana River Valley.

### Basin Governance

The following describes the governing structure within the Sweetwater and Santee-El Monte Basins.

### Sweetwater Basins-San Diego Formation

The Sweetwater Basin and the San Diego Formation are unadjudicated and do not have an adopted groundwater management plan. However, these basins are managed by the Sweetwater Authority. The basin does not have a formal governance structure or process. There is a self-imposed constraint of limiting groundwater production so seawater intrusion and land subsidence does not occur. This is accomplished through the Sweetwater Authority Interim Groundwater Management Plan that was adopted in November of 2001.

### Santee-El Monte Basin

The Santee-El Monte basin is an unadjudicated basin and there is no formal governance structure. There are no constraints or limitations imposed upon the basin's operation. The Santee-El Monte Basin is largely within the property owned by the Helix WD. In addition to

potentially competing institutional interests, water rights issues are not resolved. The City of San Diego maintains Pueblo rights to the surface flow of the San Diego River and the associated "underground flow". Helix WD also claims long-standing rights to groundwater in the Santee-El Monte basin.

#### Other South San Diego County Basins

The city of San Diego reports that a conceptual Groundwater Management Plan has been prepared for the Mission Valley Basin and there is an adopted Groundwater Management Plan for the Lower Tijuana River Valley Basin. Information was not available on groundwater management in the Otay Valley Basin.

**Table 23-2**
**Summary of Management Agencies in the Santee-El Monte Basin**

| Agency | Role |
|---|---|
| Helix WD | Primary producer from basin |
| City of San Diego | Maintain several wells for emergency supply |
| Riverview Water District | Use groundwater and imported supply. Agencies connect with Helix WD treatment plant |
| Lakeside Water District | |

Source: SDCWA Groundwater Report, 1997; Riverview Water District, 2005

### Interactions with Adjoining Basins

There are no governing agreements regarding flow into or from the South San Diego County Basins.

## WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Sweetwater Basins, the San Diego Formation and the Santee-El Monte Basin.

### Active Production Wells

The following provides a description of the existing active municipal production wells in the Sweetwater-San Formation and the Santee-El Monte Basins. Data are summarized in **Table 23-3**.

**Table 23-3**
**Summary of Production Wells in the South San Diego County Basins**

<table>
<tr><th>Category</th><th>Number of Wells</th><th>Estimated Production Capacity (AFY)</th><th>Average Production (AFY)</th><th>Well Operation Cost ($/AF)</th></tr>
<tr><td>Municipal Production</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Lower Sweetwater</td><td rowspan="3">13</td><td rowspan="3">Data not available</td><td rowspan="3">4,590</td><td rowspan="7">Data not available</td></tr>
<tr><td>Middle Sweetwater</td></tr>
<tr><td>San Diego Formation</td></tr>
<tr><td>Santee-El Monte Basin</td><td>18<br>(9 inactive)</td><td>0.7 cfs</td><td>1,600</td></tr>
<tr><td>Mission Valley</td><td colspan="2" rowspan="3">Data not available</td><td>807</td></tr>
<tr><td>Otay Valley</td><td>Data not available</td></tr>
<tr><td>Lower Tijuana River Valley</td><td>887</td></tr>
<tr><td>Other Production</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Lower Sweetwater</td><td colspan="2" rowspan="3">Data not available</td><td>900</td><td rowspan="4">Data not available</td></tr>
<tr><td>Middle Sweetwater</td><td>2,000</td></tr>
<tr><td>San Diego Formation</td><td>-</td></tr>
<tr><td>Santee-El Monte Basin</td><td>19</td><td>Data not available</td><td>4,000</td></tr>
<tr><td>Mission Valley</td><td colspan="4" rowspan="3">Data not available</td></tr>
<tr><td>Otay Valley</td></tr>
<tr><td>Lower Tijuana River Valley</td></tr>
<tr><td>Total Production</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sweetwater and S.D. Formation</td><td>13</td><td>Data not available</td><td>7,490</td><td rowspan="6">Data not available</td></tr>
<tr><td>Santee-El Monte</td><td>37</td><td>>0.7 cfs</td><td>5,600</td></tr>
<tr><td>Mission Valley</td><td colspan="2" rowspan="3">Data not available</td><td>807</td></tr>
<tr><td>Otay Valley</td><td>Data not available</td></tr>
<tr><td>Lower Tijuana River Valley</td><td>887</td></tr>
<tr><td>Total with available data</td><td>>50</td><td></td><td>14,784</td></tr>
</table>

Sources: Sweetwater Authority, 2006; Helix Water District, 2006; SDCWA Groundwater Report, 1997; City of San Diego, 2006

#### Sweetwater Basins-San Diego Formation

There are 13 municipals wells in the basin serving the cities of Chula Vista and National City and the unincorporated area of Bonita. The total production capacity of these wells is 16.4 cfs. At its National City wells, Sweetwater obtains fresh water from the San Diego Formation. At its Reynolds Groundwater Desalination Facility in Chula Vista, Sweetwater Authority extracts brackish water from the alluvium of the Sweetwater River, and from the San Diego Formation. Total average municipal production from the Lower Sweetwater, Middle Sweetwater, and San Diego Formation basins is reported at 4,590 AFY (Sweetwater Authority, 2006).

#### Santee-El Monte Basin

Prior to the importation of water into the San Diego region, Helix WD operated as many as a dozen wells in the El Monte Basin. When imported water became available, Helix WD reduced groundwater production from the basin to several hundred AFY. The final remaining Helix WD well, Well No. 100, failed in 1994. Helix WD constructed a new well, Well 101, to replace Well No. 100. The production goal for the new well is 400 to 500 AFY. Because of high concentrations of iron and manganese in the groundwater, Helix WD intends to blend the recovered groundwater with its surface water supply. Existing production is reported by Helix WD to be about 250 AFY.

Under an agreement between Helix WD and the city of San Diego, Helix WD maintains 10,000 AFY of surface water storage rights in the El Captain Reservoir. This same agreement, however, states that groundwater taken from the El Monte Basin by Helix WD is subtracted from the 10,000 AF of local runoff storage rights.

Other average municipal production in the Santee-El Monte basin includes Lakeside Water District at 1,000 AFY and Riverview Water District at 350 AFY (SDCWA, 1997). Thus, total average municipal production for the Santee-El Monte basin is estimated at 1,600 AFY.

### Other Production

There are an indeterminate number of other wells in the South San Diego County Basins that serve agricultural, industrial and private users throughout the various basins. Known information from each basin is discussed below.

#### Sweetwater Basins-San Diego Formation

There are an unknown number of other wells serving agriculture, industrial, and domestic uses. The SDCWA estimates annual groundwater production at 900 AFY from the Lower Sweetwater Basin and 2,000 AFY from the Middle Sweetwater Basin.

#### Santee-El Monte Basin

According to Helix WD, there are 19 non-municipal wells in the Santee-El Monte Basin. These wells serve 90 percent private domestic, five percent industrial and five percent agricultural users. SDCWA reports this production at 4,000 AFY.

#### Mission Valley Basin, Lower Tijuana River Valley Basin, and Otay Valley Basin

The City of San Diego reports the average production in the Mission Valley Basin at 500 gpm, or 807 AFY, and the average production in the Lower Tijuana River Valley Basin at 550 gpm, or 887 AFY. Production information on the Otay Valley Basin was not available.

### ASR Wells

There are currently no ASR wells in the South San Diego County Basins. However, future plans include the use of ASR wells. These future plans are discussed below.

#### Sweetwater Basins-San Diego Formation

There are currently no ASR wells in the Sweetwater Basins or the San Diego Formation. A 1999 report on aquifer storage and recovery in the San Diego Formation recommended four potential ASR projects for further study.

#### Santee-El Monte Basin

There are no ASR wells in the Santee-El Monte Basin. Helix WD is currently evaluating a put-and-take groundwater recharge project using recycled water on Helix-owned land.

### Spreading Basins

The following section describes current spreading basin facilities in the Sweetwater and Santee-El Monte Basins.

#### Sweetwater Basins-San Diego Formation

There are no spreading basins in the Sweetwater Basins and San Diego Formation. Recharge is derived from the runoff of seasonal precipitation in the upper reaches of the Sweetwater River Valley, discharge from the Sweetwater Reservoir, and underflow from the reservoir. Subsurface flow may also contribute recharge.

#### Santee-El Monte Basin

No spreading grounds currently exist in the El Monte Basin. However, as part of Helix's proposed El Monte Groundwater Recharge Project, spreading basins are proposed.

### Seawater Intrusion Barriers

There are no seawater intrusion barriers in the South San Diego County Basins.

### Desalters

The following section describes the desalters in the South San Diego County Basins.

### Sweetwater Basins-San Diego Formation

The Richard A. Reynolds Groundwater Desalination Facility, formerly known as a Demineralization Facility, uses reverse-osmosis treatment (RO) to remove dissolved salts and microscopic particles, such as bacteria and other contaminants which could be found in alluvial groundwater. The TDS of the feedwater is approximately 2,500 mg/L. Four alluvial wells and six deep formation wells, located along the north side of the Sweetwater River, provide source water for the facility. Whenever alluvial wells are in use, at least one formation well must operate for blending. The RO product water is blended with untreated well water to raise the TDS to prevent corrosion, and chlorine and ammonia are added to further assure disinfection. The facility, completed in 1999, can produce four million gallons of drinking water per day.

### Santee-El Monte Basin

There are no desalters in the Santee-El Monte Basin.

## GROUNDWATER LEVELS

Groundwater in the South San Diego County Basins is generally shallow with depths to groundwater ranging from less than five feet in the Santee-El Monte Basin to about 100 feet in the San Diego Formation. Limited water level data are available – available data for each basin is discussed below.

### Sweetwater Basins-San Diego Formation

Historical analysis of groundwater level data by DWR showed that the groundwater surface in the early 1980s was relatively stable, and higher than in the years preceding 1959. This is attributed to decreased groundwater pumping due to the importation of Colorado River water. A study by the Sweetwater Authority indicates that water levels in production wells near National City have remained stable since about 1957. Groundwater flow follows surface flow of the Sweetwater River.

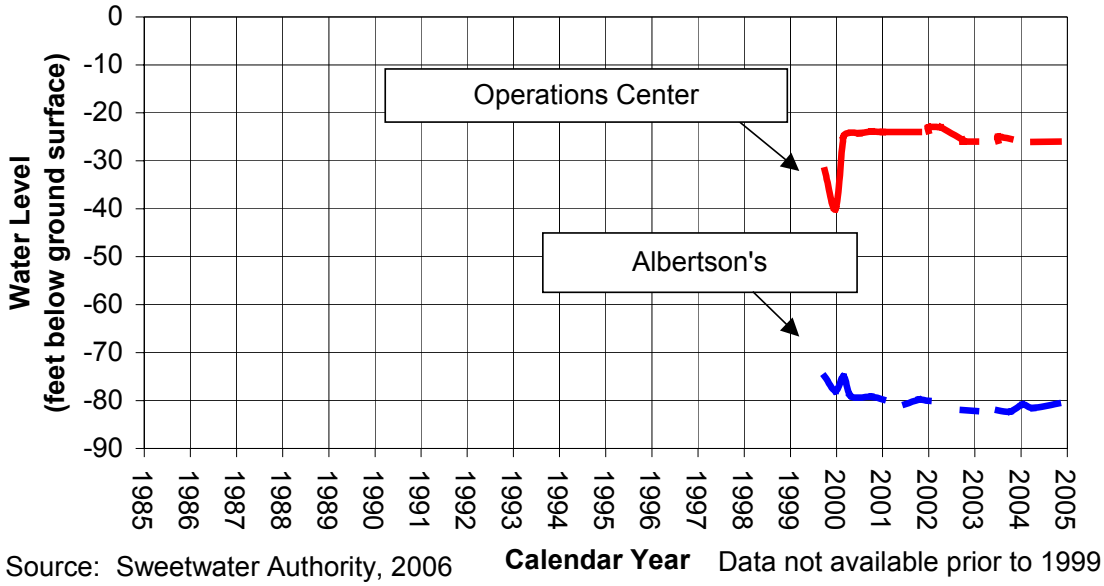
Basin water levels are closely monitored and managed by the Sweetwater Authority to avoid overpumping of the San Diego Formation. Sweetwater Authority monitors nine wells within the alluvial deposits of the Sweetwater Basins and seven wells in the San Diego Formation. Water levels in the San Diego Formation range from about 20 to 100 feet below ground surface (bgs). Historical groundwater levels monitored by Sweetwater Authority are shown in **Figure 23-3**.

### Santee-El Monte Basin

According to Helix WD, depth to groundwater in the Santee-El Monte Basin ranges from less than five to 70 feet bgs. Without recharge, water levels drop at a steady pace in the El Monte portion of the basin in response to pumping, evapotranspiration, and down gradient flow. Water levels in the Santee portion of the basin appear to be maintained over time due to urban runoff, sub-basin inflow from El Cajon and Sycamore Canyon, and groundwater flow from the east. Between 1984 and 1993, water levels gradually declined in response to below-average

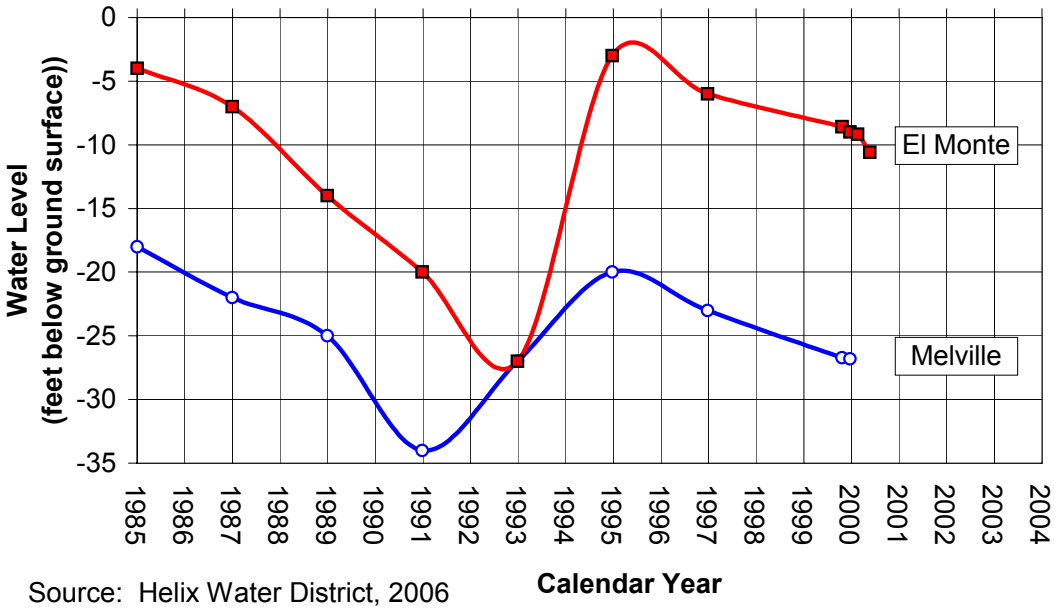
precipitation and ongoing pumping. In 1993, water levels rose to pre-1984 levels in response to above-average precipitation. Historical groundwater levels monitored by Helix WD are shown in **Figure 23-4.**

**Figure 23-3**
**Historical Water Levels in the San Diego Formation**




Source: Sweetwater Authority, 2006 Data not available prior to 1999

**Figure 23-4**
**Historical Water Levels in the Santee-El Monte Basin**




Source: Helix Water District, 2006

## GROUNDWATER QUALITY

The following section describes the water quality issues in the Sweetwater Basins, San Diego Formation and the Santee-El Monte Basin.

### Groundwater Quality Monitoring

Groundwater quality is monitored as required under Title 22. No additional monitoring program is utilized in the South San Diego County Basins.

### Groundwater Contaminants

Constituents of concern in the South San Diego County Basins include: total dissolved solids (TDS), chloride, iron and manganese. Other constituents of regional concern including nitrate, volatile organic compounds (VOCs) and perchlorate are also summarized in **Tables 23-4 and 23-5**.

#### Sweetwater Basins-San Diego Formation

The San Diego Formation historically has been a brackish groundwater basin. The high TDS is not from overpumping, but is a characteristic of the groundwater when it was deposited in the formation. There are no maps on the extent and concentration of TDS in the San Diego Formation. Contaminants of concern are summarized in **Table 23-4**.

#### Santee-El Monte Basin

Contaminants of concern for the Santee-El Monte Basin are summarized in **Table 23-5**. Groundwater quality in the eastern portion of the Santee-El Monte Basin is excellent, with low TDS concentrations, and low concentrations of iron and manganese. Groundwater quality in the central portion of the Santee-El Monte Basin is variable. Groundwater TDS concentrations range from 500 to 900 mg/L in this portion of the basin. Iron and manganese treatment is required in this area with concentrations exceeding secondary drinking water standards. Nitrate concentrations in the central portion of the basin also exceed drinking water standards with maximum concentrations of 17.8 mg/L (Regional Board, 2006). Groundwater quality in the western portion of the Santee-El Monte Basin contains high concentrations of TDS (~3,000 mg/L). Treatment is required in this area to meet drinking water standards.

#### Other South San Diego County Basins

Groundwater quality in the Mission Valley, Otay Valley and Lower Tijuana Basins is generally poor. Groundwater quality in the Mission Valley Basin is generally poor with concentrations of TDS ranging from 520 to 4,089 mg/L, chloride concentrations ranging from 80 to 1,640 mg/L, sulfite concentrations ranging from 68 to 607 mg/L, and nitrate concentrations ranging from 0 to 105 mg/L (City of San Diego, 2006). Groundwater quality in the Lower Tijuana River Valley Basin also has poor quality as the basin experiences problems with seawater intrusion. In this basin, TDS concentrations range from 379 to 1,749 mg/L and chloride concentrations range from

83 to 650 mg/L (City of San Diego, 2006). Groundwater in the Otay Valley is fair to poor with concentrations of TDS ranging from 500 to 2,000 mg/L (DWR, 2004).

**Blending Needs**

There is no blending in the Sweetwater, Santee-El Monte Basins, or other South San Diego County Basins.

**Groundwater Treatment**

As discussed above, treatment is required for TDS, iron and manganese.

**Table 23-4**
**Summary of Constituents of Concern in the Sweetwater Basins-San Diego Formation**

| Constituent | Units | Range | | Description |
|---|---|---|---|---|
| | | Sweetwater Basins | San Diego Formation | |
| **TDS**<br>Secondary MCL = 500 | mg/L | 300 to 50,000 | 600 to 1,600 | Data from 13 public supply wells shows TDS concentration ranging from 600 to 3,320 mg/L, with an average of approximately 2,114 mg/L. Groundwater in the alluvium of the Sweetwater Basins is of a sodium-calcium chloride character. |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/L | ND to 1.2 | ND | Nitrate concentrations are low in this basin |
| **VOCs**<br>**TCE and PCE**<br>Primary MCL for TCE = 5<br>Primary MCL for PCE = 5 | µg/L | ND | ND | VOCs not detected in this basin |
| **Perchlorate**<br>Notification level = 6 | µg/L | ND | ND | Perchlorate is not detected in this basin. |
| **Chloride**<br>Secondary MCL = 250 | mg/L | 692 to 1,192 | 359 to1,590 | Generally exceeds the recommended limits for drinking water. |

Source: DWR, Bulletin 118, updated 2004; Regional Board, 2006

**Table 23-5**
**Summary of Constituents of Concern in the Santee-El Monte Basin**

| Constituent | Units | Range | Description |
|---|---|---|---|
| **TDS**<br>Secondary MCL = 500 | mg/L | 260 to 2,870 | Groundwater quality in the basin is generally good in the eastern portion of the basin (<1,000 mg/L TDS) and generally poor in Lakeside and Santee (~ 3,000 mg/L TDS). |
| **Nitrate (as N)**<br>Primary MCL = 10 | mg/L | ND to 17.8 | Concentrations in 4 wells exceed nitrate MCL in central portion of basin. |
| **VOCs**<br>**TCE and PCE**<br>Primary MCL for TCE = 5<br>Primary MCL for PCE = 5 | µg/L | ND to 2.2 for PCE<br>ND for TCE | Concentrations do not exceed drinking water standards |
| **Perchlorate**<br><br>Notification level = 6 | µg/L | ND | Perchlorate is not detected in any known well. |
| **Iron**<br>Secondary MCL = 0.3 | mg/L | ND to 4.4 | Iron concentrations exceed secondary drinking water standards in central portion of basin |
| **Manganese**<br>Secondary MCL = 0.05 | mg/L | ND to 6.02 | Manganese concentrations exceed secondary drinking water standards in central portion of basin |

Sources: DWR, Bulletin 118, updated 2004; SDCWA, Groundwater Management Planning Study, Santee-El Monte Basin, Phase III Report, 2001; Regional Board, 2006

In general, VOCs and perchlorate are not detected in the Santee-El Monte Basin.

**Sweetwater Basins-San Diego Formation**

Sweetwater Authority provided information on groundwater treatment and associated costs as shown in **Table 23-6**.

**Table 23-6**
**Summary of Groundwater Treatment in the Sweetwater Basins-San Diego Formation**

| Treatment Type | Number of Wells | Constituents(s) of Concern | Treatment Target | Treatment Cost ($/AF) | Amount Treated (AFY) |
|---|---|---|---|---|---|
| Reverse Osmosis | 10 | TDS | 500 mg/L | $430 | 2,000 |

Source: Sweetwater Authority, 2006

### Santee-El Monte Basin

Well production from Helix WD's municipal production well is connected to an imported water pipeline that delivers raw water to their R.M. Levy Water Treatment Plant. All water (imported and blended groundwater from the municipal well) is treated at the R.M. Levy Water Treatment Plant to meet drinking water maximum contaminant levels (MCLs.)

Iron and manganese treatment groundwater treatment facilities in the Santee-El Monte Basin were online in 1996.

## CURRENT GROUNDWATER STORAGE PROGRAMS

The following section describes the current groundwater storage programs in the South San Diego Basins.

### Sweetwater Basins-San Diego Formation

There are no groundwater storage agreements in the basins.

### Santee-El Monte Basin

There are currently no groundwater storage programs in the Santee-El Monte basin. The Padre Dam Municipal Water District (PDMWD) and Helix WD have investigated a groundwater conjunctive use program that could develop approximately 8,500 AFY of potable water supply from the basin by groundwater recharge with PDMWD reclaimed water and a program of injection/recharge wells for imported water developing approximately 1,300 AFY of potable water supply.

## BASIN MANAGEMENT CONSIDERATIONS

The following section describes the basin management considerations for the South San Diego Basins.

**Sweetwater Basins-San Diego Formation**

- There are no pumping limitations relating to the use of additional available storage capacity in the Sweetwater Basins or the San Diego Formation. However, water quality is fair to poor and limits the ultimate use of this basin.

**Santee-El Monte Basin**

- As an unadjudicated basin, there are no constraints or limitations imposed on the basin's operation. The potential for groundwater storage and production from the Santee portion of the aquifer is extremely limited due to the limited ability to store and transmit water as well as poor water quality. The eastern portion of the basin was found to have the thickest alluvial deposits and the greatest recharge rates. Based on this observation and the modeling simulations, it appears that the greatest potential for groundwater storage and development projects are in the eastern portion of the basin, particularly in El Monte, where groundwater storage is the greatest and TDS is low.

**Other South San Diego County Basins**

- The ability to store and extract water in the South San Diego County Basins is limited primarily by water quality. As such, there are virtually no municipal supply wells in these basins.

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# CHAPTER IV

# GROUNDWATER BASIN REPORTS

# OTHER BASINS

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The following section provides a brief description of groundwater basins within the Metropolitan service area, which because of limited available data or groundwater resources, are not covered in detail in this report. These basins include:

**Los Angeles County**

- Spadra Basin
- Malibu Valley Basin

**Orange County**

- La Habra Basin

**Ventura County**

- Conejo Valley Basin
- Tierra Rejada Basin
- Thousand Oaks Basin (portion in Los Angeles County)
- Hidden Valley Basin
- Simi Valley Basin
- Russell Valley Basin (portion in Los Angeles County)

**San Diego County**

- San Marcos Basin
- Escondido Valley Basin
- Batiguitos Lagoon Basin
- San Elijo Valley Basin
- Poway Valley Basin
- El Cajon Basin

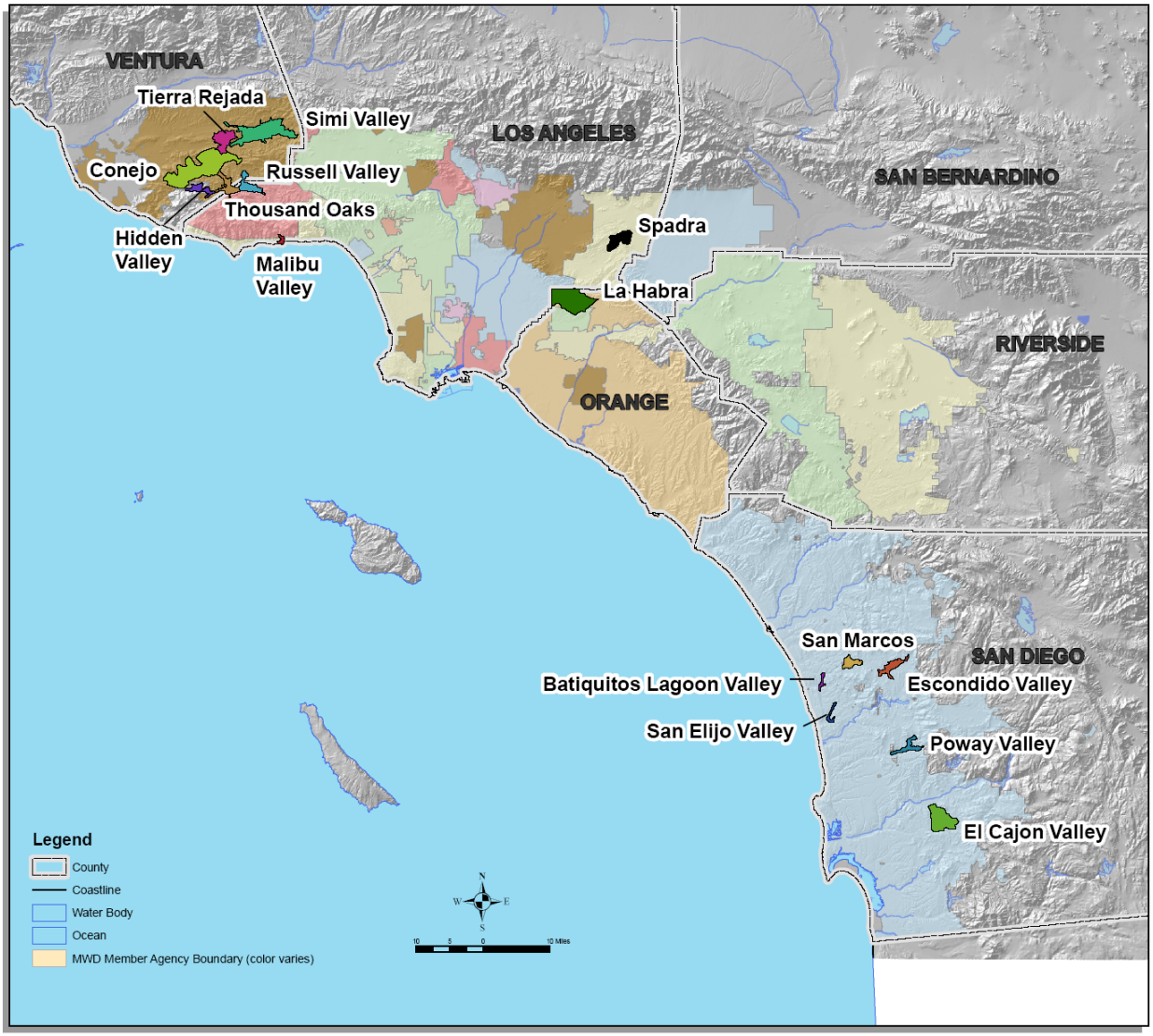
The locations of these basins are shown on **Figure 24-1**. Available data for each basin are summarized below.

**SPADRA BASIN**

The Spadra Basin is located in Los Angeles County south of the Six Basins within the city of Pomona. The Spadra Basin underlies the service areas of Metropolitan member agency Three Valleys Municipal Water District (Three Valleys MWD). The Spadra Basin is currently unmanaged. Primary producers are the City of Pomona and Cal-Poly Pomona. The conversion of agricultural land to urban in the Spadra Basin and the lining of San Jose Creek have limited groundwater recharge in the Spadra Basin. Estimated groundwater production capacity is approximately 1,500 AFY with an average production of 850 AFY (Three Valleys MWD, 2002b).

Based upon available water quality data from 1990 to 2002, concentrations of TDS and nitrate have been above applicable MCLs in the Spadra Basin. TDS concentrations during this period ranged from about 440 mg/L to 780 mg/L. Nitrate concentrations ranged from 1 mg/L to about 17 mg/L. Perchlorate, trichloroethylene (TCE) and tetrachloroethylene (PCE) have also been detected in various wells in this Basin. Maximum concentrations of perchlorate have been 11 µg/L (Regional Board, 2006). Water quality may limit the ability to store and extract water in this basin.

**Figure 24-1**
**Map of Basins not Covered**



## MALIBU VALLEY BASIN

The Malibu Valley Basin is a small alluvial basin located along the Los Angeles County coastline in the Malibu area. The basin is within the service areas of West Basin MWD and Las Virgenes MWD and served by the Los Angeles County Department of Public Works (LACDPW). Groundwater occurs primarily in alluvial, beach and terrace deposits. In addition, groundwater may be present in some sandstone rock formations underlying the recent deposits (Malibu Bay Company, 2003). Thickness of the alluvium ranges from 90 to 140 feet (DWR, 2004). Groundwater is as shallow as five feet but increases inland. Prior to 1965, when imported water was introduced to the area, groundwater was the primary source of drinking water in the Malibu area. In the past, there were more than 30 private wells in the Malibu area. In addition, public water supply wells were operated by the Malibu Water Company and LACDPW. All known wells have been abandoned. Limited water quality data are available for this basin; however, historical data seem to suggest TDS concentrations of 1,310 mg/L and evidence for historical seawater intrusion (DWR, 2004). According to LACDPW, the Malibu Valley Basin lacks capability to produce sufficient water supplies and is not included in their water supply planning (LACDPW, 2005).

## LA HABRA BASIN

The La Habra Basin is located in northern Orange County, north of the Orange County Basin, within the cities of La Habra and Brea. The La Habra Basin underlies Metropolitan member agencies Municipal Water Districts of Orange County (MWDOC) and the City of Fullerton. It comprises a shallow alluvial depression between the Coyote Hills and the Puente Hills. Little groundwater production occurs in the La Habra Basin due to low transmissivity and poor water quality (high total dissolved solids, or TDS, sulfates, nitrates and color). Potable groundwater production out of the basin has been about 1,200 AFY over the past several years by the City of La Habra. Treatment consists of air-stripping to remove hydrogen sulfide and addition of hexametaphosphate to sequester the iron and manganese; the City of La Habra has plans to expand production to a total of about 2,400AFY. (MWDOC, 2006). Hydrogeologic studies have indicated that 2,200 to 5,500 AFY of groundwater flows out of the La Habra Basin southerly into the Orange County Basin and westerly into Central Basin (OCWD, 2004). The basin is currently unmanaged.

## CONEJO VALLEY BASIN

The Conejo Valley Basin underlies the Conejo Valley in southern Ventura County. It is within the service area of Calleguas Municipal Water District (Calleguas MWD). The Conejo Valley Basin is currently unmanaged. The primary water-bearing units are unconfined alluvium and the sedimentary and volcanic rocks of the Modelo, Topanga and Conejo Formations. Average yield is about 100 gpm and is used primarily for agricultural irrigation. The alluvium is generally only a few feet thick but can be up to 60 feet thick (DWR, 2004) and is not a significant source of groundwater. The sedimentary and volcanic rocks, the primary sources of groundwater, can reach a combined thickness of about 19,500 feet. Total storage capacity of this basin has been estimated to be about 7,106 AF (Panaro, 2000;DWR, 2004). In 1999, the available storage in this basin was estimated to be about 1,776 AF (Panaro 2000, DWR, 2004). Recent pumping was

estimated to be less than 100 AFY (Panaro 2000; DWR, 2004). Available groundwater quality data suggest that the quality of the water produced from the sedimentary and volcanic units is generally poor. Future use of this basin is limited.

**TIERRA REJADA BASIN**

The Tierra Rejada Basin is near the headwaters of the Arroyo Santa Rosa in southern Ventura County. It is within the service area of Calleguas MWD. The Tierra Rejada Basin is currently unmanaged. The primary water-bearing units are unconfined alluvium and the sedimentary and volcanic rocks of the Modelo, Topanga and Conejo Formations. The alluvium is only found in the center of the basin and is estimated to be only about 25 thick and is not a significant source of groundwater (DWR, 2004). The sedimentary and volcanic rocks can reach a combined thickness of more than 8,500 feet. Average well yield is approximately 172 gpm. Total storage capacity of this basin is estimated be approximately 39,320 AF. In 1999, about 9,830 AF was available for storage (DWR, 2004; Panaro 2000). Annual production from wells is estimated to be about 1,500 AFY and is generally used for irrigation. According to DWR (2004), maximum TDS concentrations in 1996 were 930 mg/L and nitrate concentrations were 16 mg/L and high nitrate concentrations could occur locally in the basin.

**THOUSAND OAKS BASIN**

The Thousand Oaks Basin underlies a small valley between Lake Sherwood and Thousand Oaks in southeastern Ventura and western Los Angeles Counties. It is located with the service areas of Calleguas MWD and Las Virgenes Municipal Water District (Las Virgenes MWD). The Thousand Oaks Basin is currently unmanaged. Groundwater is generally found in the unconfined alluvium, although some groundwater is found in the underlying sedimentary rocks of the Modelo and Topanga Formations and fractures within the volcanic Conejo Formation. Total storage capacity of the basin is estimated to be about 130,000 AF (DWR, 2004) and had an available storage space in 1999 of about 17,000 AF (DWR 2004; Panaro, 2000). Groundwater quality is generally poor with TDS concentrations ranging from 1,200 to 2,300 mg/L (DWR, 2004). Municipal production is limited.

**HIDDEN VALLEY BASIN**

The Hidden Valley Basin underlies the Hidden Valley in southwestern Ventura County. It is within the service area of the Metropolitan member agency Calleguas MWD. The Hidden Valley Basin is unmanaged. The basin is bounded by the Santa Monica Mountains and drains into Sherwood Lake. Produced groundwater primarily comes from fractures with the volcanic rocks of the Conejo Formation and the overlying alluvium (DWR, 2004). Water level data suggest that the basin responds rapidly to precipitation. Water quality has been reported to be good to fair with TDS concentrations below 800 mg/L (DWR, 2004). Limited additional data are available for this basin.

## SIMI VALLEY BASIN

The Simi Valley Basin underlies the Simi Valley in southeastern Ventura County. It is within the service areas of Metropolitan member agency Calleguas MWD. The Simi Valley Basin is unmanaged. The basin is bounded on the north and northeast by the Santa Susana Mountains and the Simi fault and on the south and southwest by the Simi Hills. The primary water-bearing unit is unconfined alluvium. The maximum thickness is estimated to be approximately 730 feet (DWR, 2004). Total estimated groundwater storage is approximately 180,000 AF (Panaro, 2000; DWR, 2004). Total space available in 1999 was estimated to be about 8,000 AF (Panaro, 2000; DWR, 2004). Pumping is estimated to be less than 5,500 AFY (Panaro, 2000; DWR, 2004). Based upon data from public supply wells between 1990 and 1998, the TDS of the groundwater within the Simi Valley Basin ranges from about 580 mg/L to 820 mg/L (Regional Board, 2006). According to DWR (2004), there are some problems with volatile organic compounds in shallower portions of the basin and TDS concentrations can reach up to 1,580 mg/L. Groundwater from the Simi Valley Basin is generally not utilized for municipal supply.

## RUSSELL VALLEY BASIN

The Russell Valley Basin is a relatively small alluvial basin within northwestern Los Angeles and southern Ventura County. It underlies the service area of Metropolitan member agencies Calleguas MWD and Las Virgenes MWD. The basin is bounded by the Santa Monica Mountains to the north, south and east and the Thousand Oaks Basin to the west. The Russell Valley Basin is currently unmanaged. The primary water-bearing formation is unconfined alluvium but some groundwater is extracted from the underlying sedimentary and volcanic rocks of the Conejo Formation. The alluvium average about 35 to 55 thick (Las Virgenes MWD, 2005). It is estimated that the alluvium may have a total storage capacity of 11,000 AF (Las Virgenes MWD, 2005). Wells within the Conejo Formation typically yield about 200 to 400 gpm (Las Virgenes, 2005). Storage space available in the Conejo Formation is currently unknown but may range from 30,000 to 80,000 AF. Production from the Russell Valley Basin is estimated to be about 600 AFY (DWR, 2004) and is not used for municipal supply. The TDS concentrations in the Russell Valley Basin usually range from 800 to 1,200 mg/L but have also been reported to range from 400 to 2,800 mg/L. TDS and sulfate both exceed their MCL for some wells in the basin. Future utilization of this basin for municipal supply is limited.

## SAN MARCOS VALLEY BASIN

The San Marcos Valley Basin is a small groundwater basin located in western part of central San Diego County. The basin underlies the service area of the San Diego County Water Authority (SDCWA). San Marcos Creek drains this valley southwestward into Lake San Marcos. The principle water bearing materials are weathered bedrock and alluvium, with the alluvium reaching a thickness of 175 feet (DWR 2004). The basin is unmanaged. Total storage capacity, groundwater in storage, and annual groundwater production are unknown. Wells in the basin yield as much as 60 gpm from the alluvium. The basin is recharged by percolation of rainfall and ephemeral stream flow, with some additional recharge potentially occurring from water applied to landscaping. TDS concentrations measured prior to 1967 ranged

between 500 and 750 mg/L. Groundwater is suitable for domestic use and marginal irrigation in the northern part of the basin, but inferior in the south (DWR 1967).

## BATIQUITOS LAGOON VALLEY BASIN

The Batiquitos Lagoon Valley Basin underlies Green Valley and San Marcos Creek Valley in the western part of central San Diego County, within the service area of SDCWA. San Marcos and Encinitas Creeks drain the valleys westward into Batiquitos Lagoon. The primary water-bearing unit is alluvium deposits that reach a maximum thickness of about 100 feet (DWR 1967). The basin is unmanaged. Total storage capacity, groundwater in storage, and annual groundwater production are unknown. Average TDS content is about 1,280 mg/L with a range from about 788 to 2,362 mg/L. The groundwater was rated inferior for irrigation because of high chloride content and marginal for domestic use because of high sulfate and TDS concentrations (DWR 1967).

## SAN ELIJO VALLEY BASIN

The San Elijo Valley Basin is located in the western part of central San Diego County and underlies the service area of SDCWA. Escondido Creek flows occasionally through the upper northeast portions of the valley, discharging into San Elijo Lagoon. The primary water bearing units consist of alluvium and part of the sedimentary La Jolla Group. Well yields range from 10 to 1,800 gpm. Additionally, the Santiago Peak volcanics have well yields generally less than two gpm, but may reach 125 gpm (DWR 2004). The basin alluvium has an average thickness of less than 50 feet. The La Jolla Group has a maximum thickness of 1,650 feet (DWR 1967). Recharge of the alluvial aquifer is primarily from percolation in Escondido Creek, with return irrigation waters and water from residential use as additional recharge contributors. The basin is unmanaged. The total groundwater storage capacity and annual groundwater production are unknown. Groundwater in storage was estimated to be approximately 8,500 AF in 1983. TDS concentration ranges from 1,170 to 5, 090 mg/L, with concentrations lowest in the eastern part of the basin and increasing toward the west (DWR 2004).

## ESCONDIDO VALLEY BASIN

The Escondido Valley Basin is located in central San Diego County and is within the service area of SDCWA. The valley is drained by Escondido Creek. The primary water-bearing deposits include alluvium and weathered bedrock. The alluvium, primarily confined to Escondido Creek, is probably not thick enough to be water bearing. Groundwater production is largely from the weathered bedrock, however, many wells extract groundwater from fractures in the underlying crystalline rocks (DWR 1967). Groundwater is generally found at less than 50 feet in depth (DRW 1967). The basin is unmanaged. The groundwater storage capacity is estimated at 24,000 AF (DWR 1975). Groundwater in storage as well as annual production is unknown. Well yields are as high as 190 gpm, averaging 50 gpm (DWR 1975). TDS content ranges from 250 to more than 5,000 mg/L (DWR 1967). Local sources of groundwater are categorized as suitable to inferior for domestic use, with the inferior water typically containing high nitrates, TDS, or sulfate content (DWR 1967).

## POWAY VALLEY BASIN

The Poway Valley Basin is a small groundwater basin located in central San Diego County within the service area of SDCWA. The basin is drained by Poway and Los Panasquitos Creeks to the Pacific Ocean. The principal water-bearing units include alluvium and weathered bedrock. The alluvium thickness ranges from 10 to 75 feet, with an average of 40 feet. Weathered bedrock reaches about 70 feet in thickness (DWR 1967). A ridge of impermeable Santiago Peak Volcanics along the western basin boundary inhibits the flow of groundwater to the west and raises the water level in the western portion of the basin yielding a spring in the past. Natural recharge is from direct precipitation on the valley floor and infiltration along Poway Creek. Septic tank effluent and irrigation waters provide some recharge. Groundwater flow is generally to the west. The basin is unmanaged. Groundwater storage capacity and annual groundwater production are unknown. Stored groundwater was estimated at 2,330 AF. TDS content ranges from about 750 to 1,500 mg/L (DWR 1967). Water from one public well had a TDS content of 610 mg/L. The high chloride content results in marginal to inferior ratings for irrigation use in some parts of the basin (DWR 1967). A marginal rating for domestic use in some parts of the basin is due to high TDS content (DWR 1967).

## EL CAJON BASIN

The El Cajon Basin is in southern San Diego County and within the service area of SDCWA. The basin is within the San Diego River watershed and the basin drains to the north to the San Diego River. Water-bearing materials in the basin include alluvium, the Poway Conglomerate, and an older underlying sandy siltstone unit (DWR 1986). In addition, water is produced from the underlying fractured crystalline rocks. The alluvium ranges to 50 feet thick, with wells yielding as much as 250 gpm (DWR 1986). The Poway Conglomerate ranges to more than 300 feet thick. The sandy siltstone to mudstone underlies the Poway Conglomerate and reaches a maximum of about 325 feet thick (DWR 1986). Recharge is from percolation of precipitation, with lesser contributions from underflow from underlying fractured crystalline rocks. Additional recharge is from return of applied irrigation water and percolation of septic tank effluent. Groundwater moves in a northwestward direction towards the San Diego River. The basin is unmanaged. Total basin capacity is estimated to be about 32,500 AF (DWR 1986). Stored groundwater was estimated in 1984 to be about 27,800 AF (DWR 1986). Subsurface outflow to the northwest is estimated to be 100 to 140 AFY (DWR 1986). Annual groundwater production is unknown. Well yields ranged to 250 gpm (DWR 1986). TDS concentrations range from 637 to 3,960 mg/L with an average value of 1,640 mg/L (DWR 1986). Water from one public well had a TDS of 2,340 mg/L. Groundwater analyzed in 1984 had nitrate concentrations up to 185 mg/L, with a mean concentration of 69 mg/L. Chloride concentrations ranged from 186 to 1,910 mg/L, with a mean concentration of 412 mg/L. Sulfate concentrations ranged from 78 to 680 mg/L, with a mean concentration of 345 mg/L (DWR 1986).

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# APPENDICES

# APPENDIX A

# GROUNDWATER BASIN DESIGNATIONS

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**Table A-1**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| Las Posas Valley | 4-8 | Ventura County Basins | West Las Posas<br>East Las Posas<br>South Las Posas | Basin boundaries of DWR and subbasin designations have been modified by studies performed by the USGS for the Fox Canyon GMA, Updated boundaries were used in this study. |
| Santa Clara River Valley | 4.4.02 | | Oxnard Forebay<br>Oxnard Plain | |
| Pleasant Valley | 4-6 | | Pleasant Valley | |
| Arroyo Santa Rosa Valley | 4-7 | | Santa Rosa | |
| San Fernando Valley | 4-12 | Upper Los Angeles River Area Basins | San Fernando<br>Sylmar<br>Verdugo<br>Eagle Rock | Basin boundaries of DWR have been modified by the City of Los Angeles. Updated boundaries were used in this study. |
| Coastal Plain of Los Angeles County – Central Basin | 4-11.04 | Central Basin | -- | DWR basin boundaries were used in this study. |

**Table A-1 (continued)**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| Coastal Plain of Los Angeles County – West Coast Basin | 4-11.03 | West Coast Basin | -- | DWR basin boundaries were used in this study. |
| Coastal Plain of Los Angeles County – Santa Monica Basin | 4-11.01 | Santa Monica Basin | Arcadia<br>Charnock<br>Crestal<br>Coastal<br>Olympic | DWR basin boundaries were used in this study. |
| Coastal Plain of Los Angeles County – Hollywood Basin | 4-11.02 | Hollywood Basin | -- | DWR basin boundaries were used in this study. |

**Table A-1 (continued)**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | BasinName(s) (This Study) | Comments |
|---|---|---|---|---|
| San Gabriel Valley | 4-13 | Main San Gabriel and Puente Basins | Main San Gabriel<br>Puente | Basin boundaries of DWR were modified by the Main San Gabriel Watermaster. Updated boundaries were used in this study. |
| | | Six Basins | Upper Claremont<br>Lower Claremont<br>Pomona<br>Live Oak<br>Canyon<br>Ganesha | Basin boundaries of DWR have been modified by Three Valleys Municipal Water District. Updated boundaries were used in this study. |
| Raymond Basin | 4-23 | Raymond Basin | Monk Hill<br>Pasadena<br>Santa Anita | Basin boundaries of DWR have been modified by the Raymond Basin Management Board. Subbasin boundaries provided by the Raymond Basin Management Board Updated boundaries were used in this study. |

**Table A-1 (continued)**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| Coastal Plain of Orange County | 8-1 | Orange County Basin | Yorba Linda<br>Main<br>Irvine | Basin boundaries of DWR have been modified slightly by the Santa Ana Watershed Project Authority. Unlike the DWR boundary, the La Habra Basin was not included in the Orange County Basin in this study. Updated boundaries were used in this study. |
| San Juan Valley | 9-1 | San Juan Basin | -- | Basin boundaries of DWR were used in this study. |
| Upper Santa Ana Valley – Chino Subbasin | 8-2.01 | Chino and Cucamonga Basins | Chino<br>Cucamonga | Basin boundaries of DWR have been modified by the Chino Basin Watermaster. Updated boundaries were used in this study. |
| Upper Santa Ana Valley – Cucamonga Subbasin | 8-2.02 | | | |

**Table A-1 (continued)**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| Upper Santa Ana Valley – Riverside-Arlington Subbasin | 8-2.03 | Riverside Basin | Riverside North<br>Riverside South | Basin boundaries of DWR have been modified by the Santa Ana Watershed Project Authority. Updated boundaries were used in this study. |
| | | Arlington Basin | -- | Basin boundaries of DWR have been modified by the Santa Ana Watershed Project Authority. Updated boundaries were used in this study. |
| Elsinore<br><br>(Northern portion) | 8-4 | Temescal Valley Basins | Bedford<br>Coldwater<br>Lee Lake | Basin boundaries of DWR have been modified by the Santa Ana Watershed Project Authority. Updated boundaries were used in this study. |
| Upper Santa Ana Valley – Temescal Subbasin | 8-2.09 | | Temescal | |

**Table A-1**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| Elsinore<br><br>(Southern portion) | 8-4 | Elsinore Basin | -- | Basin boundaries of DWR have been modified by the Santa Ana Watershed Project Authority. Updated boundaries were used in this study. |
| San Jacinto | 8-5 | West San Jacinto Basins | Perris North<br>Perris South<br>Lakeview<br>Menifee<br>San Jacinto Lower Pressure | Basin boundaries of DWR have been modified by Eastern Municipal Water District. Updated boundaries were used in this study. |
| | | Hemet-San Jacinto Basins | Canyon<br>San Jacinto Upper Pressure<br>Hemet North<br>Hemet South | Basin boundaries of DWR have been modified by Eastern Municipal Water District. Updated boundaries were used in this study. |
| Temecula Valley | 9-5 | Temecula-Murrieta Basin | -- | Basin boundaries of DWR have been modified by Anchor Environmental Updated boundaries were used in this study. |

**Table A-1 (continued)**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| San Mateo | 9-2 | North San Diego Basins | San Mateo | Basin boundaries of DWR were used in this study for San Mateo and San Onofre Basins. Las Flores Basin boundaries provided by San Diego County Water Authority. Updated boundaries were used in this study. |
| San Onofre | 9-3 | | San Onofre | |
| | | | Las Flores | |
| Santa Margarita Valley | 9-4 | Central San Diego Basins | Lower Santa Margarita | Basin boundaries of DWR have been modified slightly by the San Diego County Water Authority. Updated boundaries were used in this study. |
| San Luis Rey Valley | 9-7 | | Mission<br>Moosa Canyon<br>Bonsall<br>Pala<br>Pauma | |
| San Dieguito Creek | 9-12 | | San Dieguito | |
| Santa Maria Valley | 9-11 | | Santa Maria | |

**Table A-1 (continued)**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| Warner Valley | 9-8 | Central San Diego Basins (continued) | Warner | Basin boundaries of DWR have been modified slightly by the San Diego County Water Authority. Updated boundaries were used in this study. |
| San Pasqual Valley | 9-10 | | San Pasqual | |
| Mission Valley | 9-14 | South San Diego Basins | Mission | Basin boundaries of DWR have been modified slightly by the San Diego County Water Authority. Updated boundaries were used in this study. |
| San Diego River Valley | 9-15 | | Santee-El Monte | |
| Sweetwater Valley | 9-17 | | Middle Sweetwater<br>Lower Sweetwater<br>San Diego Formation | |
| Otay Valley | 9-18 | | Otay Valley | |
| Tia Juana | 9-19 | | Lower Tijuana | |

**Table A-1 (continued)**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin(s) (This Study) | Comments |
|---|---|---|---|---|
| San Gabriel Valley (Southeast portion) | 4-13 | Other Basins Not Covered | Spadra | Spadra Basin boundary provided by Three Valleys Municipal Water District. |
| Malibu Valley | 4-22 | | Malibu Valley | Basin boundaries of DWR were used in this study. |
| Coastal Plain of Orange County | 8-1 | | La Habra | Basin boundaries of DWR have been modified by the Santa Ana Watershed Project Authority. Updated boundaries were used in this study. |
| Conejo Valley | 4-10 | | Conejo Valley | Basin boundaries of DWR were used in this study. |
| Tierra Rejada | 4-15 | | Tierra Rejada | Basin boundaries of DWR were used in this study. |
| Thousand Oaks Area | 4-19 | | Thousand Oaks | Basin boundaries of DWR were used in this study. |

**Table A-1**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| Hidden Valley | 4-16 | Other Basins Not Covered (continued) | Hidden Valley | Basin boundaries of DWR were used in this study. |
| Simi Valley | 4-9 | | Simi Valley | Basin boundaries of DWR were used in this study. |
| Russell Valley | 4-20 | | Russell Valley | Basin boundaries of DWR were used in this study. |
| San Marcos Area | 9-32 | | San Marcos | Basin boundaries of DWR were used in this study. |
| Escondido Valley | 9-9 | | Escondido Valley | Basin boundaries of DWR were used in this study. |
| Batiguitos Lagoon | 9-22 | | Batiguitos Lagoon | Basin boundaries of DWR were used in this study. |
| San Elijo Valley | 9-23 | | San Elijo Valley | Basin boundaries of DWR were used in this study. |

**Table A-1**
**Summary of Basin Designations**

| DWR Basin Name(s) | DWR Basin Number(s) | Basin Report Name (This Study) | Basin Name(s) (This Study) | Comments |
|---|---|---|---|---|
| Poway Valley | 9-13 | Other Basins Not Covered (continued) | Poway Valley | Basin boundaries of DWR were used in this study. |
| El Cajon | 9-16 | | El Cajon | Basin boundaries of DWR were used in this study. |

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# APPENDIX B

# SUMMARY OF GROUNDWATER BASIN MANAGEMENT

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**Table B-1**
**Groundwater Basin Management**

| Groundwater Basin | Governance Type | Characteristics |
|---|---|---|
| Ventura County Basins Oxnard Plain, Oxnard Forebay, Santa Rosa, East, West, and South Las Posas Basins | Managed via 1982 State statute creating the Fox Canyon Groundwater Management Agency | Specifies the establishment of a representative board of directors to govern the Fox Canyon GMA. Specifies the scope of the GMA to planning, managing, controlling, preserving, and regulating the extraction and use of groundwater within it service territory, and may adopt ordinances to carry out these purposes. Statute recognizes conjunctive use of surface and groundwater and long-term storage of water in a groundwater basin. Requires the preparation and implementation of a groundwater management plan. The GMA adopted its Groundwater Management Plan in 1985 and updated the plan in 2006. |
| Upper Los Angeles River Area Basins | Adjudicated in 1979. Prior stipulated judgments from 1958 through 1965 are merged into the 1979 judgment | The judgment distinguishes the San Fernando, Sylmar, Verdugo and Eagle Rock basins, finds them to be separate basins and sets out separate and distinct rights within each basin. The judgment sets out the separate conditions of the basins with respect to overdraft and safe yield and sets out the rights of the parties to surface and groundwater. Judgment expressly recognizes stored water -- imported or reclaimed water that is intentionally spread or safe yield water that is stored in-lieu and provides for separate accounting and recapture subject to specific requirements. Judgment provides for appointment of a watermaster and specifies powers and duties of the watermaster. Judgment establishes an administrative committee. |
| Central Basin | Adjudicated in 1965 and amended in 1991 | The judgment sets out the annual pumping rights of each of the parties; appoints DWR as watermaster; specifies the duties, powers and responsibilities of watermaster; provides for carryover of 20% of annual pumping rights for one year, or 35% carryover under the 'drought carryover' provisions; 20% overpumping to be paid back the following year, or prorated over the following 5 years under specified conditions; provides for an exchange pool wherein a right not used by one party can be made available to another. Judgment makes no provision for storage and recapture of stored water beyond the specified extraction right and specifies that 'no party…has any right to extract ground water from Central Basin except as herein affirmatively determined.' |

**Table B-1 (continued)**
**Groundwater Basin Management**

| Groundwater Basin | Governance Type | Characteristics |
|---|---|---|
| West Coast Basin | Adjudicated in 1977 and most recently amended in 1989 | The judgment sets out the annual pumping rights of each party, provides for carryover of 10% of annual pumping rights for one year, overpumping of 10% to be replaced the following year, an exchange pool wherein a right not used by one party can be made available to another, emergency overpumping up to a total of 10,000AF under specified conditions, and appoints DWR as watermaster. |
| Santa Monica Basin | Unadjudicated | The primary producer in the basin is the city of Santa Monica. |
| Hollywood Basin | Unadjudicated | Ordinances adopted by the city of Beverly Hills address dewatering of groundwater. |
| Main San Gabriel Basin | Adjudicated in 1973 and as amended in 1989 | Judgment defines natural safe yield under 1967 cultural conditions, specifies annual pumping rights, allows one year for carry-over of unused water rights, enjoins unauthorized recharge, restricts export of groundwater. Judgment establishes watermaster to administer the judgment including assumption of Make-Up obligation on behalf of the basin, storage of supplemental water, and concern with water quality matters. Judgment provides for determination of annual operating safe yield, specifies basin operating criteria that replacement water shall not be spread when the water level at the Key Well exceeds elevation 250 and that replacement water shall be spread as practicable to maintain the water level at the Key Well above elevation 200. Judgment Exhibit H estimates that a usable volume of 400,000 AF of storage space within the operating range of elevations 200 to 250. Judgment allows overproduction of rights, but this production incurs replacement water assessment. |
| Puente Basin | Adjudicated in 1986 | Judgment provides for a watermaster, and authorizes the watermaster to determine the annual operating safe yield and the annual pumping rights. The judgment provides for carryover of 100% of pumping rights, excess pumping of up to 10%, and restricts exportation of groundwater. The judgment makes no provisions for storage of surplus water supplies within the basin. |

**Table B-1 (continued)**
**Groundwater Basin Management**

| Groundwater Basin | Governance Type | Characteristics |
|---|---|---|
| Raymond Basin | Adjudicated in 1943. Judgment modified and restated in 1984 | Judgment specifies safe yield in the Eastern and Western units of the basin, addresses rights to capture surface water for spreading and percolation and rights to recapture spread water, specifies groundwater pumping rights of the parties, allows for 10% overpumping to be made up in the following year, and 10% carryover for one year. Judgment establishes the Raymond Basin Management Board as watermaster with specified powers and responsibilities including: protecting the long-term quantity and quality of the groundwater supply, utilizing the groundwater storage capacity of the basin for the maximum advantage of the parties, integrating surface and groundwater supplies, and mutual cooperation. |
| Six Basins | Adjudicated in 1998 | Judgment sets out the safe yield for Six Basins inclusive of active spreading and imported water return flows. Establishes procedure for setting annual operating safe yield for 4 of the 6 basins (Canyon, Upper and Lower Claremont Heights, and Pomona basins), allows overproduction but with obligation for replacement water, establishes annual surface water and groundwater production rights, provides for storage and recovery beyond annual production rights, establishes a watermaster, allows portability of rights within the 4 basins subject to specified conditions, and sets out priorities for use of groundwater storage capacity. |
| Orange County Basin | Managed via 1933 State statute, as amended, creating the Orange County Water District | The OCWD Act establishes the Orange County Water District and sets out its powers for the purpose of managing the groundwater basin and managing, replenishing, regulating, and protecting groundwater supplies including: provide for conjunctive use of ground and surface waters; regulate and control the storage of water and use of groundwater basin storage space; purchase and import water; appropriate and acquire water and water rights; determine the Basin Pumping Percentage; levy a basin equity assessment on parties who produce more than the BPP; prevent interference with basin water, water rights, impacts to water quality, and unlawful exportation of basin water; and to be a party to all groundwater storage agreements within the basin. The Act specifies that use of the groundwater basin for replenishing and managing the groundwater supplies shall have priority over use of the groundwater basin for storage of water. OCWD manages the basin utilizing its Groundwater Management Plan prepared in 1989 and 1990, updated in 1994 and 2004. |

**Table B-1 (continued)**
**Groundwater Basin Management**

| Groundwater Basin | Governance Type | Characteristics |
|---|---|---|
| San Juan Basin | Unadjudicated | Informally managed by San Juan Basin Authority, however, private producers do not participate or report to San Juan Basin Authority. Groundwater pumping rights governed by State Water Resources Control Board water rights. |
| Chino Basin | Adjudicated in 1978 | Judgment appoints Chino Basin Watermaster to administer and enforce the Judgment and any subsequent instructions or orders of the Court. Judgment provides numeric value for natural safe yield and allocates this natural safe yield among three pools of producers. The judgment also provides for 5,000AFY (200,000 AF of controlled overdraft averaged over 40 years (operating safe yield)). Pumping in excess of safe yield is allowed, but incurs a replenishment obligation. The judgment expressly provides for groundwater storage and conjunctive use. The Court directed the Watermaster to develop the Optimum Basin Management Program (OBMP) addressing enhancement of basin water supplies, protection and enhancement of water quality, enhancement of basin management, and equitable financing of the OBMP. In 2004, the Water Quality Control Board, Santa Ana Region, incorporated the Maximum Benefit Basin Plan into its Water Quality Control Plan for the Santa Ana River Basin. |
| Cucamonga Basin | Adjudicated in 1959 | Judgment specifies water rights for individual groundwater producers and specifies the amount that can be exported to non-overlying areas for use by individual producer. Judgment specifies requirement for spreading. No annual report is prepared to document implementation of judgment requirements. |
| Riverside Basin | Adjudicated in 1959 and superseded in 1969 and effective 1971 | Judgment distinguishes the portions of Riverside Basin in San Bernardino and Riverside counties and sets out the average annual extraction for each portion of the Riverside Basin. Judgment establishes a watermaster to administer and enforce the judgment provisions. Judgment provisions for extraction without replenishment obligation: extraction from the San Bernardino County portion for use *outside* San Bernardino Valley and from the Riverside County portion is each limited over 5 years to 5 times the annual average. Replenishment is required if the extraction in any year is 20% more than the annual average in a basin portion. Extractions from the Riverside Basin within San Bernardino County for use *within* San Bernardino Valley are not limited except that static water levels in the area shall not fall below a specified water elevation. Judgment specifies that it does not limit rights to spread, store and recapture imported water. |

**Table B-1 (continued)**
**Groundwater Basin Management**

| Groundwater Basin | Governance Type | Characteristics |
|---|---|---|
| Arlington Basin | Unadjudicated | There are no formal restrictions on basin production. Western MWD reports on basin water extractions and operates the Arlington Desalter. |
| Temescal Valley Basins—Temescal, Bedford, Coldwater, Lee Lake basins | Unadjudicated | The city of Corona is preparing a groundwater management plan for Temescal Basin estimated for completion in 2007. Temescal Valley Basins subject to 1970 Santa Ana River Judgment requiring minimum annual average adjusted baseflow at Prado Dam. |
| Elsinore Basin | Groundwater Management Plan adopted in 2004 | The Groundwater Management Plan addresses basin hydrogeology, geology, groundwater balance, water quality and identifies groundwater management issues, groundwater management strategies, reviews alternatives, presents an implementation plan and a basin monitoring plan. |
| West San Jacinto Basins | Groundwater Management Plan adopted in 1995 | The Groundwater Management Plan addresses active recharge, recovery of degraded groundwater to be blended with imported water, recovery of brackish water, conjunctive use, and agricultural groundwater exchange. |
| Hemet-San Jacinto Basins | Canyon and San Jacinto Upper Pressure subject to the 1954 Fruitvale Judgment.<br>Other basins are unadjudicated. | Groundwater management plan in process for the Hemet-San Jacinto Basins and will supersede the Fruitvale Judgment. The Groundwater Management Plan addresses reducing groundwater production, implementing the San Jacinto River Recharge and Recovery Project, groundwater replenishment, in-lieu water use, additional water conservation measures and water monitoring. |
| Temecula-Murrieta Basin | Adjudicated by the Court with decree with decree entered on April 6,1966 | The Temecula-Murrieta Basin is part of the Santa Margarita watershed and subject to the Santa Margarita River adjudication. Judgment does not quantify water rights, but specifies certain operational requirements and facts, defines the scope of the watershed and lands and current owners within the jurisdiction of the court, and retains continuing jurisdiction for the court to quantify the water rights at a future time. Since the judgment was entered, several memoranda and agreements have been adopted for operations throughout the watershed basin. There are pending lawsuits concerning water rights and stream flows in the Santa Margarita River watershed. |
| Lower Santa Margarita River Basins | | Adjudication administered by the Court and the Santa Margarita River Watermaster with assistance from the Watershed Steering Committee. See discussion of Temecula-Murrieta Basin. |

**Table B-1 (continued)**
**Groundwater Basin Management**

| Groundwater Basin | Governance Type | Characteristics |
|---|---|---|
| San Luis Rey River Valley Basins | Unadjudicated | The San Luis Rey River Valley basins are informally managed by the San Luis Rey Watershed Council. The Council adopted the San Luis Rey Watershed Management Guidelines in 2000. |
| San Dieguito River Basins | Unadjudicated | The San Dieguito Basin Task Force is evaluating feasibility of groundwater management. |
| Lower and Middle Sweetwater Basins and San Diego Formation | Unadjudicated | Managed pursuant to Sweetwater Authority Interim Groundwater Management Plan adopted in 2001. The Interim Plan sets out groundwater management strategies: maintain groundwater levels, protect groundwater quality, monitor seawater intrusion, monitor groundwater quality and quantity; and implementation and data collection and management directives. |
| Lower Tijuana River Basin | Managed | Groundwater management plan adopted in 1995. |
| Mission Valley Basin | Unadjudicated | Conceptual groundwater management plan developed. |
| Santee-El Monte, San Mateo, San Onofre, Las Flores/Las Pulgas basins | Unadjudicated | No management structure for these basins. |

Sources for Table B-1, Groundwater Basin Management

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City of Beverly Hills. Agenda Report: An Ordinance of the City of Beverly Hills Relating to the removal of groundwater and amending the Beverly Hills municipal code. August 21, 2006.

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Groundwater Management Plan, Orange County Water District. March 2004.

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Hemet-San Jacinto Water Management Area 2005 Annual Report, Eastern Municipal Water District (Eastern MWD), 2006.

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Upper San Gabriel Valley Municipal Water District vs. City of Alhambra, et al., Superior Court of the County of Los Angeles. Case No. 924128 Amended Judgment. August 24, 1989.

Western Municipal Water District of Riverside County vs. East San Bernardino County Water District, et al., Superior Court of the County of Riverside. Case No. 78426 Judgment. April 17, 1969.-