

# Chapter IV – Groundwater Basin Reports

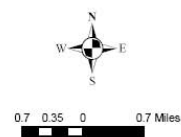
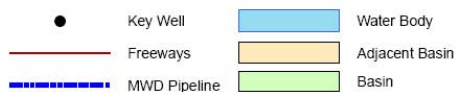
## Los Angeles County Coastal Plain Basins - Santa Monica Basin

The Santa Monica Basin is located in the northwestern portion of the coastal plain of Los Angeles County. The Santa Monica Basin is within the service areas of the Metropolitan member agencies of the cities of Santa Monica, Los Angeles, Beverly Hills and West Basin Municipal Water District (West Basin MWD) and underlies the cities of Santa Monica, Culver City, and Beverly Hills and the communities of Pacific Palisades, Brentwood, Venice, Marina del Rey, West Los Angeles, Century City and Mar Vista. The Santa Monica Basin is divided into five subbasins: Arcadia, Olympic, Coastal, Charnock, and Crestal. A map of the basin is provided in **Figure 5-1**.

**Figure 5-1**  
**Map of the Santa Monica Basin**



**Santa Monica Basin**



## BASIN CHARACTERIZATION

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

### Basin Producing Zones and Storage Capacity

The basin is bounded by the Santa Monica Mountains to the northwest, the Pacific Ocean to the west and southwest, the Newport-Inglewood fault to the northeast, and the Ballona escarpment and Baldwin Hills to the south and southeast. The Santa Monica Basin is separated from the West Coast Basin by the Ballona Gap. As described above, faults subdivide the Santa Monica Basin into five sub-basins: Arcadia, Olympic, Coastal, Charnock and Crestal. Hydrogeologic data are provided in **Table 5-1**.

**Table 5-1**  
**Summary of Hydrogeologic Parameters of Santa Monica Basin**

<b>Parameter</b>	<b>Description</b>
<b>Structure</b>	
Aquifer(s)	Alluvium (Ballona aquifer) Lakewood Formation San Pedro Formation (Silverado aquifer)
Depth of groundwater basin	Up to 550 feet
Thickness of water-bearing units	Ballona aquifer: 30 to 50 feet Lakewood Formation: 100 feet Silverado aquifer: Up to 280 feet
<b>Yield and Storage</b>	
Natural Safe Yield	~7,500 AFY
Total Storage	1.1 million AF
Unused Storage Space	Unknown
Portion of Unused Storage Space Available for Storage	Unknown

Total depth of the Santa Monica Basin is as much as 500 feet. Groundwater occurrence in the Santa Monica Basin is generally confined with some areas of unconfined or perched groundwater. The primary groundwater-producing zones within the Santa Monica Basin include aquifers within the recent alluvium and the underlying San Pedro Formation of the Los Angeles Coastal Plain. The Recent alluvium reaches a maximum thickness of about 90 feet and includes the clays of the Bellflower aquiclude and the underlying Ballona aquifer, which is also referred

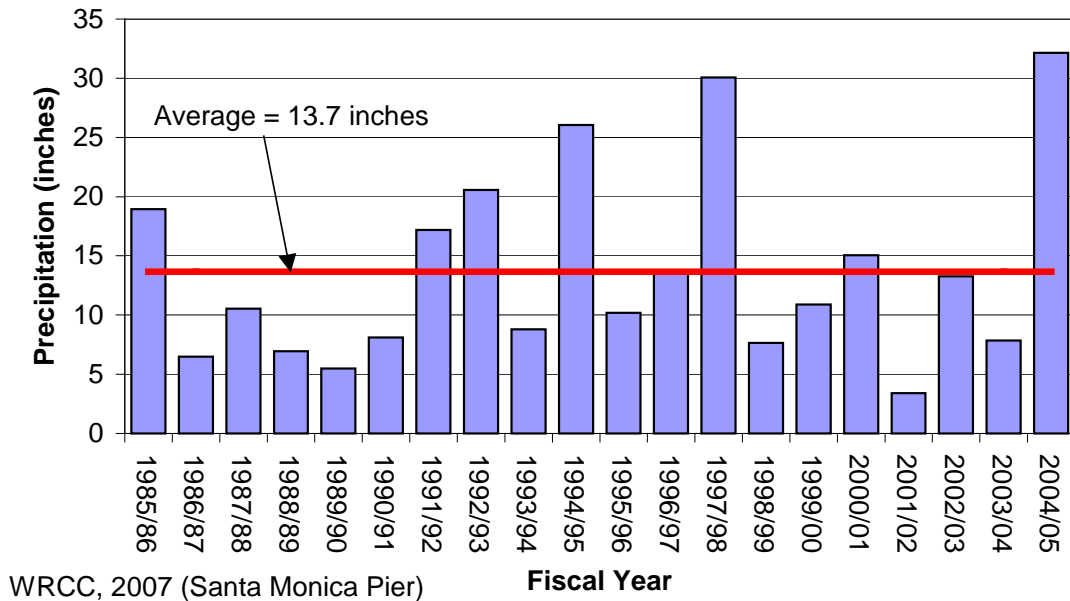
to as the “50-foot gravel.” Perched groundwater may occur in this unit. The Lakewood Formation, a significant aquifer within other areas of Los Angeles County appears to be present only in the northern half of the basin; wells in the Arcadia and Olympic subbasins utilize this aquifer. Other unnamed sand units also occur. The main potable production aquifer in the Santa Monica Basin is the Silverado aquifer of the San Pedro Formation. This aquifer is up to 280 feet in thickness in the Santa Monica Basin. Additional fresh-water units lie below the San Pedro Formation, but are not widely produced (DWR 1961).

Total storage in the Santa Monica Basin has been estimated to be approximately 1.1 million AF (DWR, 1961). Current storage space is unknown.

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

The primary source of groundwater recharge into the Santa Monica Basin is percolation of precipitation and surface runoff from the Santa Monica Mountains. Water is discharged from the basin via surface runoff and subsurface outflow to the south. Natural recharge from precipitation and runoff is the largest inflow to the basin. **Figure 5-2** provides the historical precipitation data from 1985 to 2004. Average precipitation during this time period was approximately 13.7 inches. Although no formal safe yield determination has been made for the Santa Monica Basin, based upon studies performed by the USGS, the average yield based upon estimated inflows and outflows between 1971 and 2000 was about 7,500 AFY (USGS, 2003).

**Figure 5-2**  
**Historical Precipitation in the Santa Monica Basin**



## GROUNDWATER MANAGEMENT

The following section describes how the Santa Monica Basin is currently managed including a discussion of the governing structure and relationship to adjoining basins.

### Basin Governance

The Santa Monica Basin is an unadjudicated basin. The primary producer in the basin is the city of Santa Monica. As discussed below, the groundwater management in the Santa Monica Basin has centered primarily around the cleanup of groundwater contaminated by MTBE, most notably in the Arcadia and Charnock subbasins. The cleanup operations are coordinated/overseen by the Los Angeles Regional Water Quality Control Board.

**Table 5-2**  
**Summary of Management Agencies in the Santa Monica Basin**

Agency	Role
City of Santa Monica	Primary producer in basin Operation of treatment facilities
California Department of Health Services	Oversight of cleanup of Arcadia and Charnock Wellfields
California Regional Water Quality Control Board – Los Angeles Region	Coordination and oversight of cleanup of Charnock and Arcadia Wellfields.

### Interactions with Adjoining Basins

The Santa Monica Basin is adjacent to the Hollywood Basin to the north and east, the West Coast Basin to the south and the Central Basin to the east. The flow into the Hollywood and Central Basins is restricted by the Newport-Inglewood Uplift. Average outflows (1971 to 2000) are estimated to be about 1,000 AFY into the West Coast Basin (USGS, 2003). There are no formal agreements governing this flow.

## WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Santa Monica Basin. Facilities include 12 groundwater production wells and treatment facilities associated with the MTBE and volatile organic compound cleanups in the Arcadia and Charnock subbasins.

### Active Production Wells

There are currently 19 production wells (13 drinking water, 6 irrigation) within the Santa Monica Basin. Only five drinking water wells and four irrigation wells are currently in production. Prior to 1996, about 50 percent of the supply within the city of Santa Monica came from groundwater produced from the Arcadia, Charnock and Olympic subbasins. Since 1996, when

Santa Monica's Arcadia and Charnock wellfields were shut down due to MTBE and VOC contamination, about 95 percent of the city's water has been from imported water supplied by Metropolitan. The remainder of city's water comes from the Olympic subbasin wells, which have not been impacted by MTBE contamination (USEPA, 2006). Total existing capacity of active wells is approximately 3,300 gpm (Santa Monica, 2005).

Historical production within the Santa Monica Basin is summarized in **Figure 5-3**. Average production between 2000 and 2004 was approximately 1,800 AFY compared to a high of about 10,300 AFY in 1995 when contamination was discovered. Between 1985 and 1996, about 6,100 AFY was produced from the Charnock subbasin. Since 1996, production from this basin has been limited.

**Table 5-3**  
**Summary of Production Wells in the Santa Monica Basin**

Subbasin	Number of Wells	Estimated Production Capacity <sup>1</sup> (AFY)	Average Production 1999/00 - 2004/05 (AFY)	Well Operation Cost (\$/AF)
Arcadia	5 wells: 3 drinking (active) 2 irrigation (inactive)	450	261	Data not available
Charnock	7 drinking wells (inactive)	12,800	0	
Coastal	0	0	0	
Crestal	4 irrigation wells (active)	0	0	
Olympic	3 drinking wells 2 active 1 inactive	2,900	1,577	
<b>Total</b>	<b>19 wells</b> <b>9 active</b> <b>10 inactive</b>	<b>Active Wells</b> <b>3,350 AFY</b> <b>Inactive Wells</b> <b>12,800 AFY</b>	<b>1,838</b>	

Source: Santa Monica, 2000b, 2005, 2006

<sup>1</sup>Maximum annual production in past 5 years or rated pump capacity in Charnock subbasin

### Other Production

All production in the Santa Monica Basin is designated for municipal use.

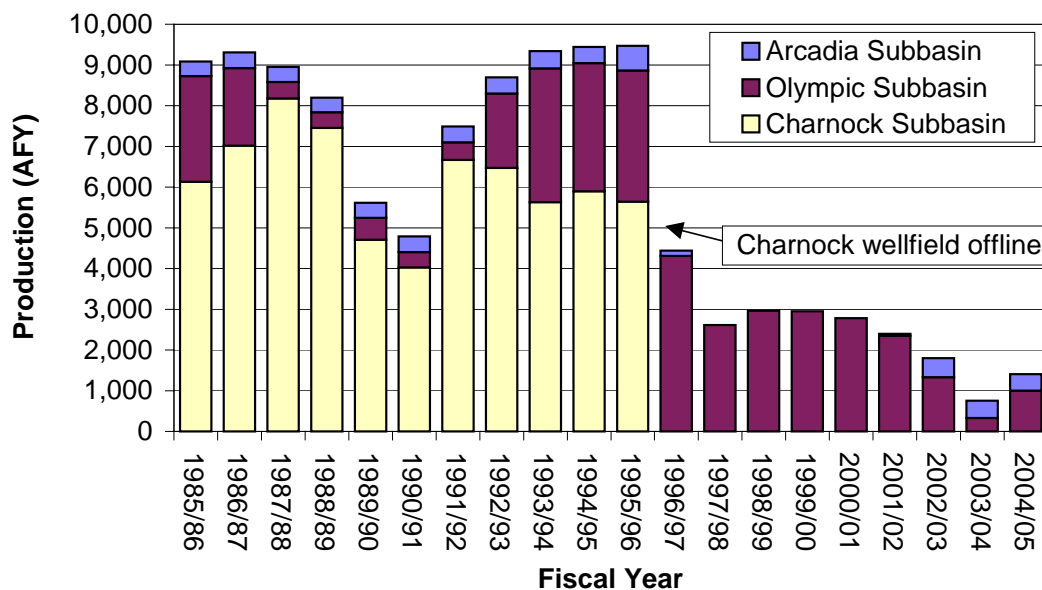
### ASR Wells

There are no currently active ASR wells in the Santa Monica Basin. During the 1980s, the city of Santa Monica injected up to 2,148 AFY of imported water from Metropolitan into the Charnock subbasin (DBS & A, 1999). This injection was stopped in 1990.

### Spreading Basins

There are no spreading basins in the Santa Monica Basin.

**Figure 5-3**  
**Historical Groundwater Production in the Santa Monica Basin**



Source: City of Santa Monica, December 2006

### Seawater Intrusion Barriers

There are no seawater intrusion barriers in the Santa Monica Basin.

### Desalters

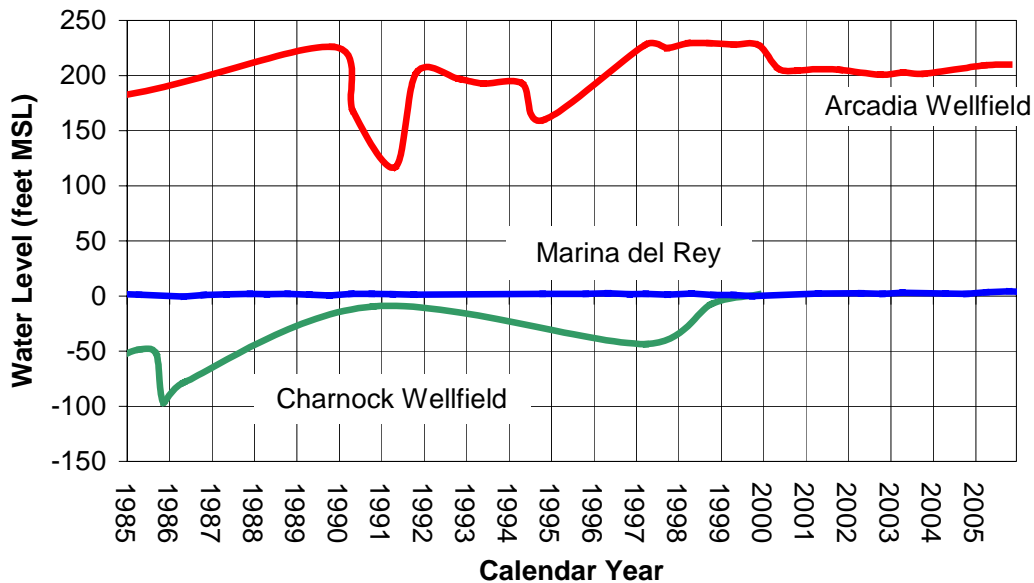
There are no desalters in the Santa Monica Basin.

### GROUNDWATER LEVELS

Groundwater flow is generally from the Santa Monica Mountains in the north toward the West Coast Basin to the south. **Figure 5-4** shows representative hydrographs for key wells throughout the basin. In general, water levels in the Arcadia subbasin ranged from about

100 feet above MSL to 230 feet above MSL between 1985 and 2005. Well production in the Coastal subbasin is limited, in part, because water levels in this area are at or below sea level. The risk for seawater intrusion in this area is high. Water levels in the Charnock subbasin were as low as 100 feet below MSL prior to 1996 when the wells in this area were turned off because of MTBE contamination. Water levels in this area are currently at or near sea level.

**Figure 5-4**  
**Historical Water Levels in the Santa Monica Basin**



**GROUNDWATER QUALITY**

The following section describes the groundwater quality issues within the Santa Monica Basin. Groundwater quality in the Santa Monica Basin is generally fair to poor with total dissolved solids (TDS) concentrations ranging from 729 to 1,156 mg/L (DWR, 2004). MTBE contamination in production wells has been a primary concern for the Santa Monica Basin.

**Groundwater Quality Monitoring**

Groundwater quality samples are collected from active production wells within the Santa Monica Basin in accordance with California DHS requirements as specified in Title 22 of the California Code of Regulations. In addition, groundwater quality has been evaluated as part of the cleanup operations in the Charnock subbasin. No basin-wide monitoring program has been established.

### Groundwater Contaminants

Groundwater constituents of concerns for the Santa Monica Basin include: TDS, nitrate, VOCs, and MTBE. Perchlorate has not been detected in the Santa Monica Basin. A summary of the range and extent of these constituents is provided in **Table 5-4**.

**Table 5-4**  
**Summary of Constituents of Concern in Santa Monica Basin**

Constituent	Units	Range	Description
<b>TDS</b> Secondary MCL = 500	mg/L	Arcadia:664 to 738 Olympic:800 to 960 Charnock: 650 to 1,251	TDS ranges from 664 to 1,251 mg/L.
<b>Nitrate (as N)</b> MCL = 10	mg/L	Arcadia: 1.1 to 6.8 Olympic: ND to 9.1 Charnock: ND to 5	Nitrate concentrations meet drinking water standards.
<b>VOCs (TCE and PCE)</b> TCE MCL = 5 PCE MCL = 5	µg/L	Arcadia: TCE: ND to 7.8 PCE: ND Olympic: TCE: ND to 100 PCE: ND to 23.9 Charnock: TCE: ND to 17.7 PCE: ND	PCE only detected in 1 well in Olympic subbasin TCE has ranged from non-detect to 100 µg/L
<b>Perchlorate</b> Notification level =6	µg/L	Arcadia: ND Olympic: ND Charnock: ND	Perchlorate not detected
<b>MTBE</b> Secondary MCL = 5	µg/L	Arcadia: ND to 86.5 Olympic: ND Charnock: ND to 610	Cleanup in underway in Arcadia and Charnock subbasins. Wells in Charnock subbasin remain offline.
<b>1,4-dioxane</b> Notification level = 3	µg/L	Olympic: ND to 20	The City of Santa Monica has detected 1,4-dioxane in its Olympic production wells.

Source: Regional Board, 2006 (data from 1990-2002); Santa Monica, 2006

TDS concentrations in the Santa Monica Basin exceed the secondary standard of 500 mg/L for TDS. Blending or treatment is required to meet drinking water standards.

Trichloroethylene (TCE) was detected in the Olympic subbasin in 1979 with maximum detections up to 190 µg/L. Air strippers were installed in the wells in this subbasin in the mid 1980s (Santa Monica, 2000b). More recently, the City of Santa Monica has detected 1,4-dioxane in its Olympic production wells.

MTBE, a chemical in reformulated gasoline was first detected in groundwater extracted from production wells at the Charnock and Arcadia subbasins in 1995. In 1996, all water supply wells in the Charnock well field were shut down due to persistent and increasing levels of volatile organic contaminants and MTBE.

**Blending Needs**

While the City of Santa Monica blends various source waters prior to disinfection and distribution, the City is not permitted to utilize blending as a treatment option for contaminated groundwater.

**Groundwater Treatment**

A summary of the groundwater treatment activities is provided in **Table 5-5**.

**Table 5-5**  
**Summary of Groundwater Treatment in the Santa Monica Basin**

Subbasin	Constituent Treated	Treatment Type	Average Amount Treated (AFY)
Arcadia	None	None	Not applicable
Charnock	MTBE	To be determined	To be determined
Olympic	TCE	Mechanical surface aeration	1,450
<b>Total</b>	--	--	<b>1,450</b>

Source: Santa Monica, 2006

A shallow aquifer and vadose remediation system (SAVRS) and lower aquifer remediation system (LARS) were installed at the Arcadia wells to remediate the MTBE-affected zones (Santa Monica, 2005).

In November 1999, Shell Oil Company began operating a groundwater extraction and treatment system on Tuller Avenue south of Venice Boulevard. This system is extracting and treating shallow and deep groundwater from wells on both the west side and east side of the 405 freeway

along with wells on and adjacent to an operating Shell gas station. This system, which has a treatment capacity of approximately 300 gallons per minute, increased its operations to approximately 450 gallons per minute as of January 2002. USEPA and the Regional Board have required periodic adjustments in the operation of this system in order to clean up the area around the Venice and Sepulveda intersection (USEPA, 2006).

In December 2003, the city of Santa Monica and some of the companies responsible for the MTBE contamination of the Charnock subbasin received court approval for a settlement under which the companies will fund construction and operation of a treatment plant at the City's Charnock Wellfield. This treatment plant will clean up residual regional MTBE contamination. Because the treatment plant will provide a protective remedy, EPA does not plan to undertake additional remedy selection at the site. The Regional Board will remain the lead agency to insure that all individual source site cleanups are properly completed. DHS in consultation with the Regional Board will oversee the permitting, construction and operation of the treatment plant provided for in the settlement. (USEPA).

To date, over 100 million gallons of contaminated groundwater has been treated in the Charnock subbasin, over 17,000 pounds of hydrocarbons have been removed using soil vapor extraction (SVE), and over 4100 cubic yards of contaminated soil has been excavated and removed (USEPA, 2006).

### **CURRENT GROUNDWATER STORAGE PROGRAMS**

There are no current groundwater storage programs in the Santa Monica Basin.

### **BASIN MANAGEMENT CONSIDERATIONS**

Considerations that could limit the ability to store and extract water in the Santa Monica Basin are based upon water quality concerns. They include:

- Several wells are offline because of MTBE and TCE contamination, which limits the ability to store and extract in this basin
- Potential for seawater intrusion may limit ability to store and extract water in this basin

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