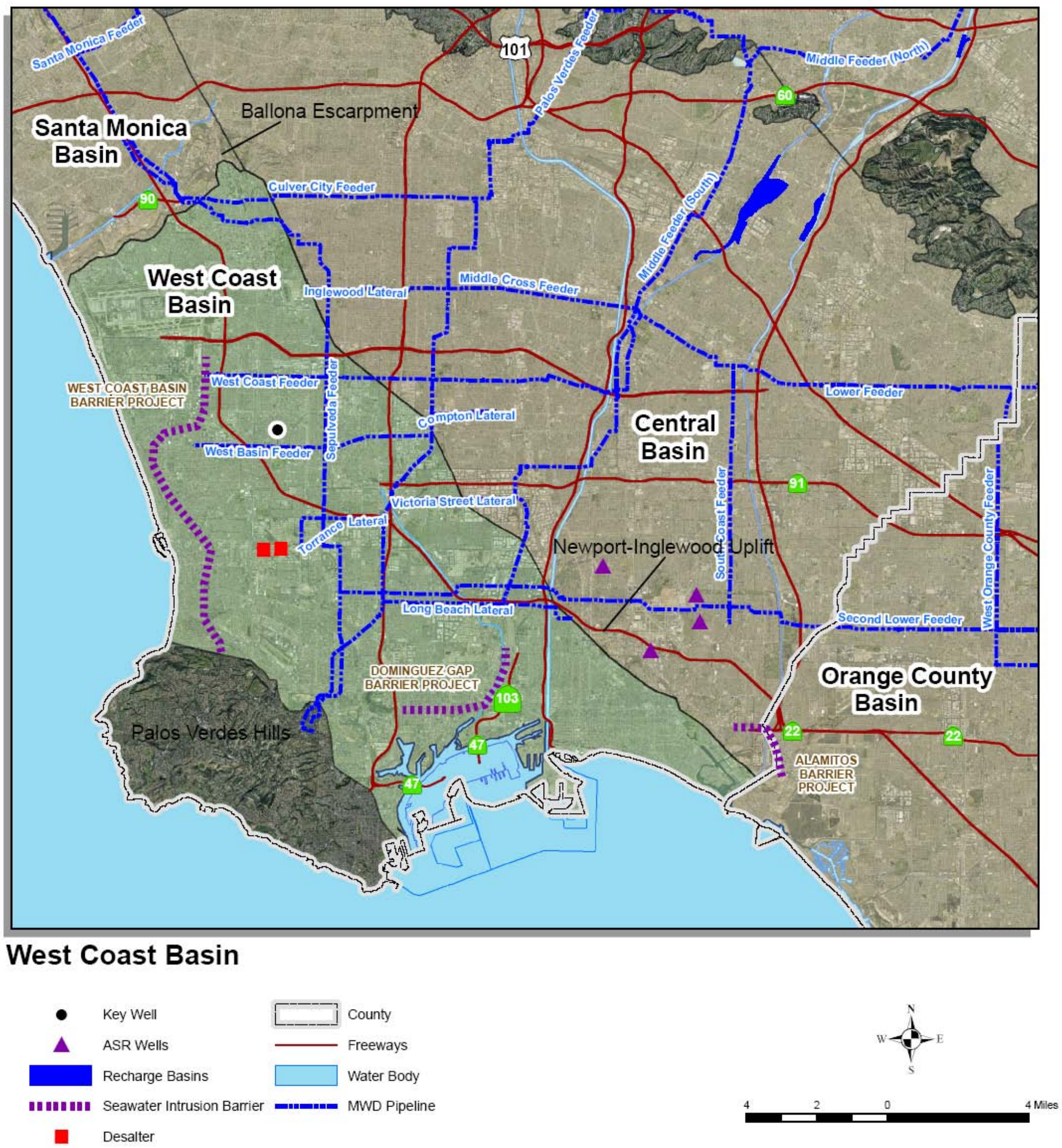
The West Coast Basin lies along the coast in western Los Angeles County. It overlies the service areas of Metropolitan member agencies: West Basin Municipal Water District (WBMWD), City of Los Angeles, City of Torrance, and the City of Long Beach. The cities of El Segundo, Manhattan Beach, Hermosa Beach, Redondo Beach, Torrance, Inglewood, Hawthorne, Gardena, Lomita, Carson and Long Beach overlie the basin. A map of the West Coast Basin is provided in **Figure 4-1**.

Figure 4-1
Map of the West Coast Basin



BASIN CHARACTERIZATION

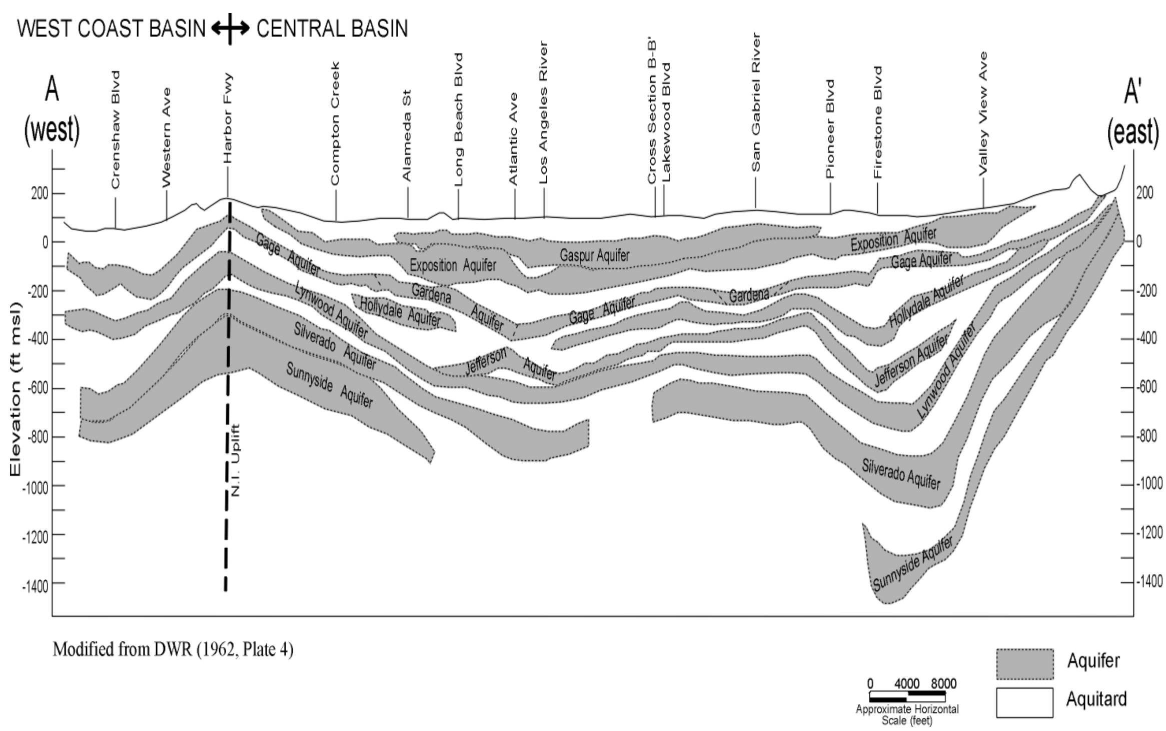
The following section provides a physical description of the West Coast Basin, including its geographic location and hydrogeologic character.

Basin Producing Zones and Storage Capacity

The West Coast Basin is bounded on the south and west by the Pacific Ocean, on the north by the Ballona Escarpment, on the east by the Newport-Inglewood Uplift, and on the south by the Palos Verdes Hills (DWR, 2005). Hydrogeologic parameters for the West Coast Basin are summarized in **Table 4-1**.

Groundwater in the West Coast Basin is generally confined. The Silverado aquifer underlying most of West Coast Basin is the most productive aquifer in the basin. It ranges from 100 to 500 feet thick and yields 80 to 90 percent of the groundwater extracted annually (DWR, 2004). This aquifer generally correlates with the Main aquifer of Orange County. A generalized cross section is shown in **Figure 4-2**. Minor yield also comes from the Gage, or “200-foot sand”, aquifer, the Lynwood, or “400-foot gravel”, aquifer and the Sunnyside, or Lower San Pedro aquifer.

Figure 4-2
Generalized Hydrogeologic Cross Section of West Coast Basin and Central Basin



Source: WRD, 2004

Table 4-1
Summary of Hydrogeologic Parameters of West Coast Basin

Parameter	**Description**
Structure	
Aquifer(s)	Pressure area (confined) • Alluvium (Gaspur and Semi-perched aquifers) • Lakewood Formation (Gardena and Gage "200-foot sand" aquifers) • San Pedro Formation (Lynwood "400-foot gravel", Silverado, and Sunnyside aquifers)
Depth of groundwater basin	~800 to 2,000 feet
Thickness of water-bearing units	Alluvium (up to 180 feet) Lakewood Formation (up to 320 feet) San Pedro Formation (up to 1,050 feet)
Yield and storage	
Natural safe yield	26,300 AFY (WRD, 2006e)
Adjudicated Rights	64,468.25 AFY
Total Storage	6.5 million AF
Unused Storage Space	1.1 million AF
Portion of Unused Storage Space Available for Storage	120,000 AF

Source: WRD, 2006c and 2006e and DWR, 2004.

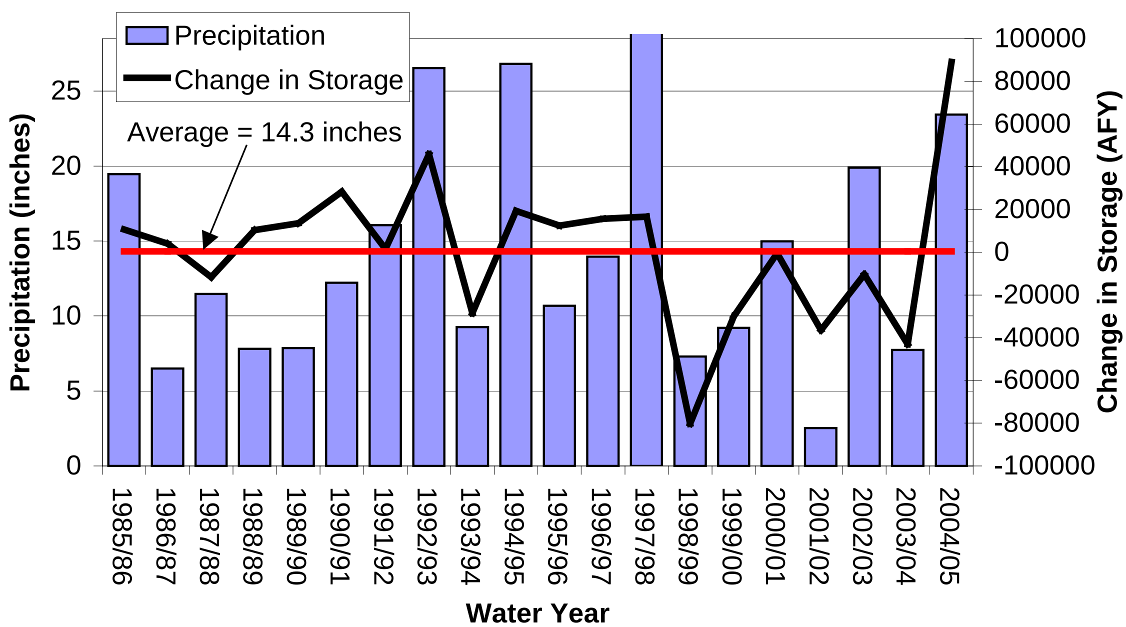
Total storage in the West Coast Basin is estimated to be approximately 6.5 million AF. Unused storage space is estimated to be approximately 1.1 million AF. Of the unused storage space, the amount available for groundwater storage is approximately 120,000 AF assuming that up to 75 feet below the ground surface is actually available (WRD, 2006e).

Safe Yield/Long-Term Balance of Recharge and Discharge

Figure 4-3 shows the historical precipitation as it relates to the change in storage calculated by WRD (2006c). These data show that the average precipitation in the West Coast Basin is approximately 14.3 inches per year. In general, storage in the West Coast Basin increases during wet years and decreases during dry years. The average change in storage in the combined Central and West Coast Basins since 1985 was approximately 1,300 AFY, suggesting that the basins are nearly balanced.

The primary source of natural recharge to the West Coast Basin is subsurface inflow from the Central Basin and surface inflow into the uppermost aquifers from rainfall. This natural safe yield, which represents the yield as a result of native waters alone, of the West Coast Basins has been estimated by WRD to be approximately 26,300 AFY (WRD, 2006e), of which approximately 7,100 AFY is from seawater intrusion (WRD, 2006e). The managed safe yield of West Coast Basin is equal to the 64,468.25 AFY (the adjudicated production limit discussed below), which is substantially higher than the natural safe yield. This higher yield is possible because of artificial recharge maintained by the Water Replenishment District of Southern California (WRD).

Figure 4-3
Historical Precipitation and Change in Storage for West Coast Basin



GROUNDWATER MANAGEMENT

The following section describes how the West Coast Basin is currently managed.

Basin Governance

The West Coast Basin is adjudicated. The West Coast Basin adjudication (Judgment) was finalized in 1961 and capped annual production at 64,468 AFY. The Judgment allows annual carryover of unpumped adjudicated right not to exceed 20 percent and also allows up to 20 percent excess production to be made up by under-production the following year. The Judgment also allows up to 10,000 AF of emergency overpumping under specified conditions. The California Department of Water Resources (DWR) serves as Watermaster. The Water Replenishment District of Southern California (WRD), established in 1959, has the statutory authority to replenish the groundwater basin and address water quality issues. The

Los Angeles County Department of Public Works (LACDPW) owns and operates the West Coast Barrier Project and the Dominguez Gap Barrier Project. WRD procures imported and recycled water to be recharged by LACDPW at these facilities.

Table 4-2 provides a list of the management agencies in the West Coast Basin.

Each year WRD makes a determination of the amount of supplemental recharge that is needed based on an estimation of the ensuing year's groundwater production and an estimation of the annual change in storage based on groundwater levels collected throughout the basin.

The WRD adopted Interim Rules for Conjunctive Use Storage and In-Lieu Exchange and Recovery in the Central and West Coast Basins in May 2005. The rules govern storage in the basins outside and above the adjudicated water rights that would utilize up to 450,000 AF (120,000 AF in West Coast Basin and 330,000 AF in Central Basin) of unused space in the two basins. As of June 2006, the interim rules were the subject of on-going controversy among some groundwater producers in the basins and WRD.

Table 4-2
Summary of Management Agencies in the West Coast Basin

Agency	Role
California Department of Water Resources	Court appointed Watermaster to administer the Judgment
Water Replenishment District of Southern California	Replenish groundwater, address water quality, administer storage in Central and West Coast Basins
Los Angeles County Department of Public Works	Operation of West Coast Barrier Project and Dominguez Gap Barrier Project facilities
California Regional Water Quality Control Board – Los Angeles Region (Regional Board)	Issuance of permit for injection of recycled water in seawater intrusion barriers

Note: WRD's authority to administer storage is the subject of disagreement among basin parties.

Available storage capacity addressed by WRD Interim Rules is 450,000 acre-feet (a portion of this is in Central Basin). This estimated capacity is based upon modeling and takes into account water level requirements but not soil or water quality issues that could reduce the available storage capacity.

Interactions with Adjoining Basins

The Newport Inglewood Uplift is a major structural feature that acts as a partial barrier to groundwater flow between the Central and West Coast Basins. Discontinuities associated with Charnock and Overland faults in West Coast Basin also appear to affect groundwater flow

(USGS, 2003). Approximately 7,100 AFY is estimated to enter the West Coast Basin from the ocean (WRD, 2006e;USGS, 2003). Most of this occurs on the seaward side of the barriers or in areas where production does not occur.

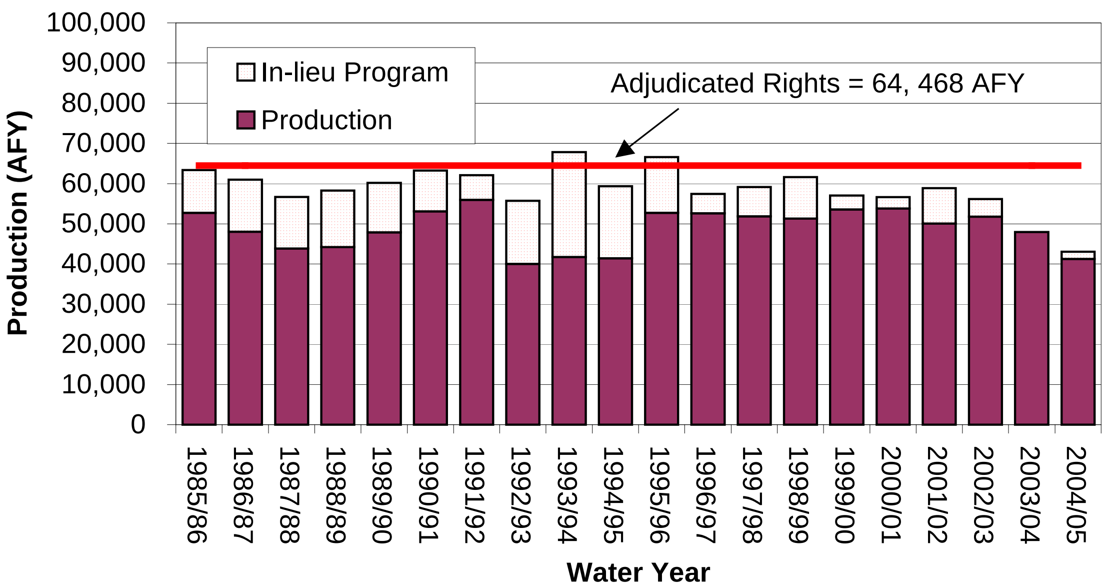
WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the West Coast Basin. Key storage and extraction facilities include 111 production wells and associated facilities, 247 injection wells associated with the Dominguez Gap and West Coast Basin Barrier Projects, 514 monitoring wells and two desalters (DWR, 2005).

Municipal Production Wells

There are currently 111 municipal production wells in the West Coast Basin, 63 active wells and 48 inactive wells (DWR, 2005). There are also 761 other wells in the basin that include groundwater monitoring wells or seawater intrusion barrier wells. These data are provided in **Table 4-3**. Historical production from all sources between water years 1985/86 and 2004/05 is shown in **Figure 4-4**. An average of approximately 48,797 AFY was produced from the West Coast Basin between water years 1985/86 and 2004/05. This average is nearly 16,000 AFY less than the allowable extractions under the Judgment.

Figure 4-4
Historical Groundwater Production in the West Coast Basin



West Coast Basin producers participate in an in-lieu groundwater replenishment programs whereby they receive imported water from Metropolitan in lieu of pumping groundwater.

Between water years 1985/86 and 2004/05, about 9,800 AFY was stored in-lieu. These and other storage programs are discussed in more detail below.

Table 4-3
Summary of Production Wells in the West Coast Basin

Category	Number of Wells	Estimated Production Capacity (AFY)	Average Production 1985-2004 (AFY)	Well Operation Cost ($/AF)
Municipal	111	Data not available	48,797	$65 Pumping Cost
Active	63			
Inactive	48			
Other	761			
Total	**872**			

Source: WRD, 2006d and DWR, 2005

Other Production

Production data provided above includes water that is desalted by the Goldsworthy and Brewer desalters. These facilities are discussed in more detail below.

ASR Wells

There are no ASR wells in the West Coast Basin.

Spreading Basin

There are no spreading basins in the West Coast Basin.

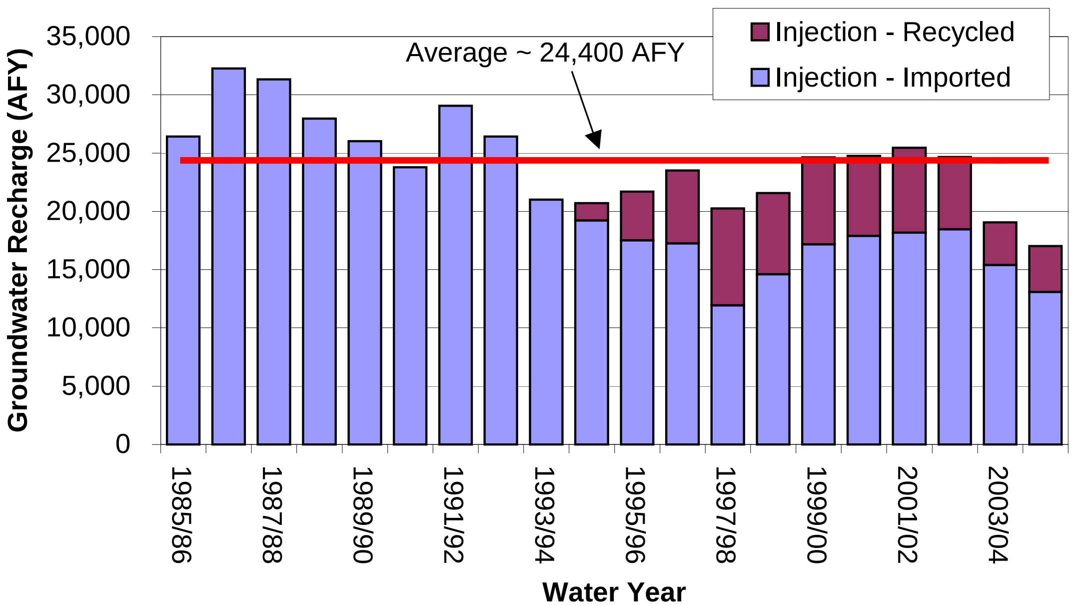
Seawater Intrusion Barriers

There are two seawater intrusion barriers in the West Coast Basin: the West Coast Basin Barrier Project and the Dominguez Gap Barrier Project. Amounts of water injected are summarized in **Figure 4-5**. An average of about 24,400 AFY was injected into these barriers between water years 1985/86 and 2004/05.

The West Coast Basin Barrier Project, which began operation in 1953, is a line of 153 injection wells that parallels the coastline from Los Angeles International Airport to the Palos Verdes Hills. It is owned and operated by the Los Angeles County Department of Public Works. Since 1995, the West Coast Basin Barrier Project has injected an approximate 35 percent blend of imported water from Metropolitan and tertiary (including reverse osmosis) treated wastewater from the Hyperion Plant. It injects water into the "200-foot sand", Silverado and Lower San Pedro aquifers to impede seawater intrusion (LACDPW, 2006).

The Dominguez Gap Barrier Project began operation in 1971. The barrier currently comprises a line of 41 injection wells and 107 observation wells along the Dominguez Channel to the 110 Freeway in the City of Carson (LACDPW, 2006). Imported water from Metropolitan is currently injected into the "200-foot sand," "400-foot gravel" and Silverado aquifers in this area. WRD, LACDPW, and LADWP initiated delivery of recycled water to this barrier in 2006.

Figure 4-5
Historical Groundwater Recharge in the West Coast Basin



Desalters

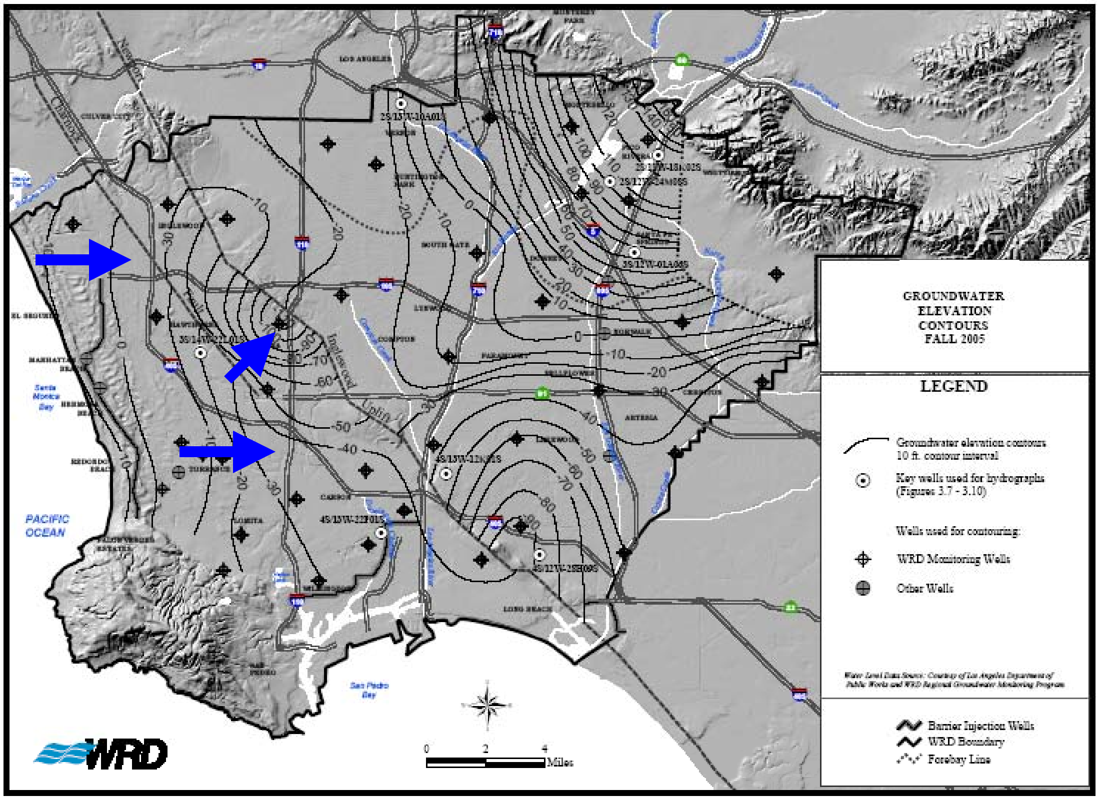
Two desalter projects used to treat brackish groundwater trapped within the Silverado aquifer on the landward side of the West Coast Basin Barrier Project are operating within the City of Torrance: Brewer Desalter and the Goldsworthy Desalter. An average of about 2,500 AFY was treated by the two desalters as of 2004/05. The Brewer Desalter was constructed by WBMWD in 1993 and is now operated by California Water Service Company. The capacity of the Brewer Desalter is 1.5 MGD. The Brewer Desalter was offline during 2004 and 2005 during the construction of a new desalter well.

WRD constructed and has operated the Goldsworthy Desalter since 2001. An average of approximately 1,900 AFY was treated between 2001 and the end of water year 2004/05.

GROUNDWATER LEVELS

As shown in **Figure 4-6** groundwater levels in fall 2005 range from about 10 feet above MSL in the northern part of the basin to more than 110 feet below MSL inland near the community of Gardena. Groundwater levels throughout most of the West Coast Basin are below sea level and generally flow from the west-northwest to the east-southeast. In the key well shown in **Figure 4-7**, water levels increased about 10 feet between water years 1985/86 and 2004/05, which is consistent with the water balance discussed above.

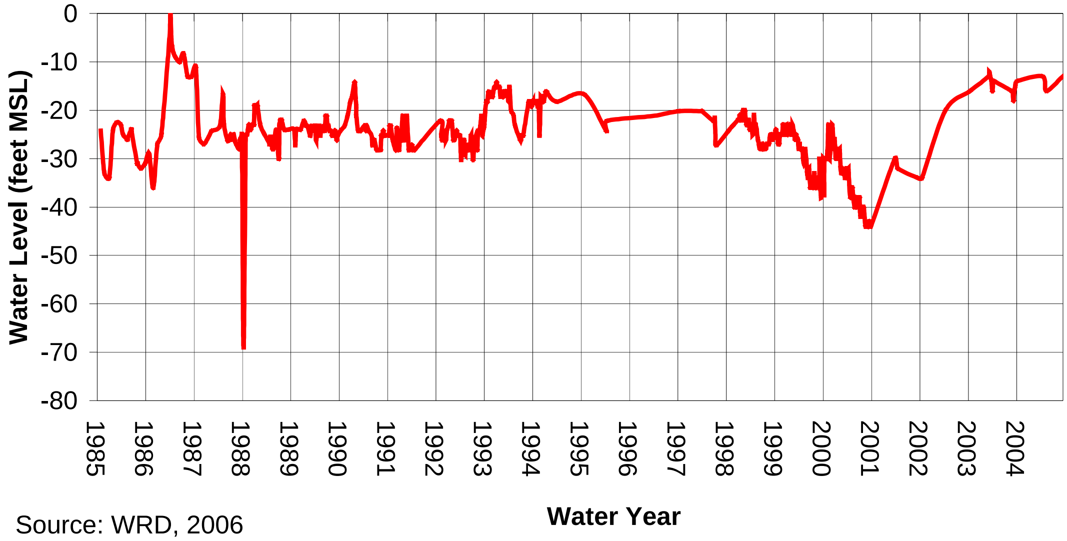
Figure 4-6
Groundwater Contour Map in the West Coast Basin – Fall 2005



GROUNDWATER QUALITY

In general, groundwater in the main producing aquifers of the basins is of good quality with average total dissolved solids (TDS) concentrations around 500 mg/L. Localized areas of marginal to poor water quality exist, primarily on the basin margins and in the shallower and deeper aquifers impacted by seawater intrusion. The following section provides a brief description of the groundwater quality issues in the West Coast Basin.

Figure 4-7
Historical Water Levels in West Coast Basin



Source: WRD, 2006

Groundwater Quality Monitoring

In 1995, WRD and the U.S. Geological Survey (USGS) began a cooperative study to improve the understanding of the geohydrology and geochemistry of Central and West Coast Basins. Out of this effort, came WRD's geographic information system (GIS) and the Regional Groundwater Monitoring Program. Twenty-one depth-specific, nested monitoring wells located throughout the basin allow water quality and groundwater levels to be evaluated on an aquifer-specific basis. Regional Groundwater Monitoring Reports are published by WRD for each water year. Constituents monitored include: TDS, iron, manganese, nitrate, TCE, PCE, arsenic, chromium including hexavalent chromium, MTBE, and perchlorate.

Groundwater Contaminants

Constituents of concern TDS, TCE, PCE, perchlorate, nitrate, iron, manganese and chloride are summarized in **Table 4-4**. Most production wells have TDS concentrations less than 750 mg/L with a range of 150 to 13,600 mg/L in the monitoring wells measured by WRD. Higher TDS concentrations found in production wells in Torrance/Hawthorne area and in monitoring wells within the brackish plume.

Organic constituents of concern (TCE, PCE, or perchlorate) were not detected in concentrations above applicable MCLs in the West Coast Basin. Neither TCE nor PCE were detected in any production well in the West Coast Basin. TCE was detected in three monitoring wells and PCE was detected in one monitoring well.

Nitrate (as nitrogen) concentrations range from non-detect to 12 mg/L in the monitoring wells in the West Coast Basin. Higher concentrations tend to be limited to the uppermost zones and are likely due to localized infiltration and leaching. Production wells have nitrate concentrations less than 3 mg/L.

Table 4-4
Summary of Constituents of Concern in the West Coast Basin

Constituent	Units	Range	Description
TDS Secondary MCL = 500	mg/L	150 to 13,600 Average: 500	Most production wells have TDS less than 750 mg/L. Higher TDS concentrations found in production wells in Torrance/Hawthorne area and in monitoring wells within saline plume.
VOCs **(TCE and PCE)** Primary MCL for TCE = 5 Primary MCL for PCE = 5	µg/L	ND to 18 for TCE ND to 0.8 for PCE	TCE nor PCE not detected in production wells. TCE detected in three monitoring wells. PCE detected in one monitoring well.
Perchlorate Notification level = 6	µg/L	Data not available	Detected in three monitoring wells below action level in shallow zones
Nitrate (as N) Primary MCL = 10	mg/L	ND to 12 mg/L	Higher concentrations tend to be limited to the uppermost zones and are likely due to localized infiltration and leaching. Production wells have concentrations less than three mg/L.
Iron and manganese Secondary MCL for iron =0.3 Secondary MCL for Mn = 0.05	mg/L	ND to 1.2 for iron and manganese	Nearly 1/3 of all production wells in northwestern portion of West Coast Basin exceed secondary MCL for iron. 17 of 30 production wells tested had concentrations above secondary MCL for manganese
Chloride Secondary MCL = 500	mg/L	5.8 to 6,180 mg/L	Chloride concentrations exceed chloride MCL in five of 15 nested monitoring wells due to seawater intrusion. One production well had concentrations above MCL.

Source: WRD, 2006b

Iron and manganese were detected in concentrations above the secondary MCL for these constituents in both monitoring wells and production wells in the basin. Nearly one-third of all production wells in northwestern portion of West Coast Basin have concentrations that exceed secondary MCL for iron. Seventeen of 30 production wells tested had concentrations above secondary MCL for manganese.

As discussed above, seawater has invaded the Silverado Aquifer along the coastal stretch of the West Coast Basin and chloride concentrations range from 1,000 to 6,000mg/l. (DWR, 2005). Chloride concentrations exceed the chloride MCL in five of 15 nested monitoring wells due to seawater intrusion. One production well had chloride concentrations above MCL.

Blending Needs

Data related to blending needs and practices are not available for the West Coast Basin.

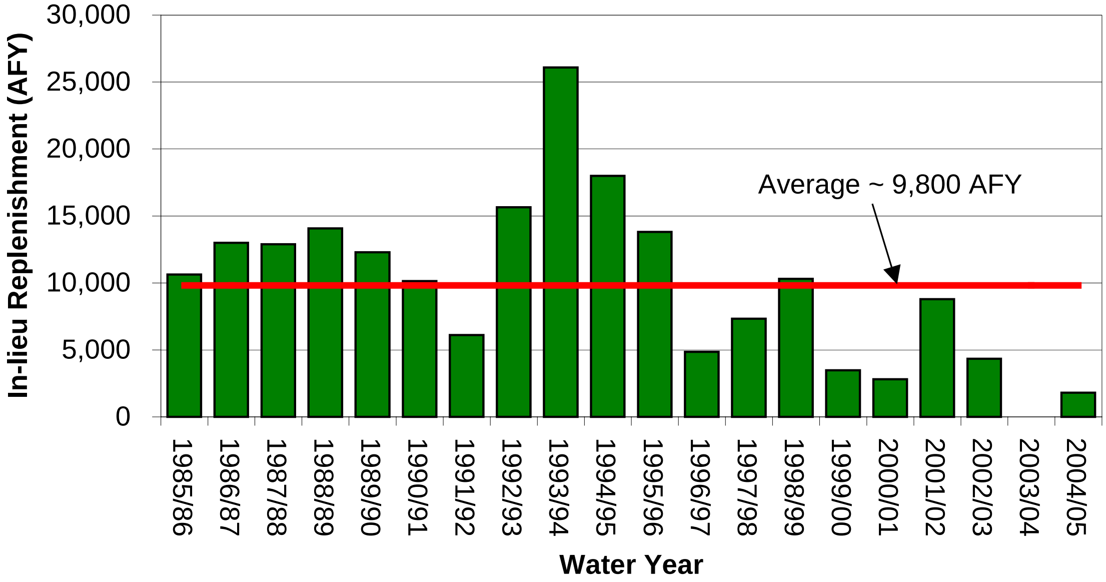
Groundwater Treatment

As discussed above, about 2,500 AFY has been treated by the Brewer and Goldsworthy desalters since 2000. In addition, oil recovery and cleanup programs operated by the oil refineries in the West Coast Basin have treated an average of about 900 AFY since 2000. About 7 percent of the total water produced in 2004/05 in the West Coast Basin was treated. Costs for treatment are not available at this time.

EXISTING GROUNDWATER STORAGE PROGRAMS

WRD operates an in-lieu replenishment program. An average of about 9,800 AFY of in-lieu storage has been generated in the West Coast Basin through this program since 1985. These data are summarized in **Figure 4-8**. No other formal groundwater storage programs are operational in the West Coast Basin.

Figure 4-8
Historical In-lieu Storage for West Coast Basin



BASIN MANAGEMENT CONSIDERATIONS

Management considerations in the West Coast Basin include:

- Extraction is limited by the Judgment to 64,468 AFY.
- The Regional Board regulates injection of recycled water and limits the amount of recycled water that can be injected.
- Brackish water inland of the West Coast Basin Barrier may limit the ability to store and extract water in some parts of the basin. The Brewer and Goldsworthy Desalters have increased the ability to use this part of the basin.
- Because most of the West Coast Basin is confined, there are no identified locations for spreading.
- Disagreements related to the Interim Rules for Conjunctive Use Storage and In-Lieu Exchange and Recovery in the Central and West Coast Basins may limit the ability to store water in the West Coast Basin. At this time, the approval of storage projects is administered by WRD using the framework defined in the Interim Rules for Conjunctive Use Storage and In-Lieu Exchange and Recovery in the Central and West Coast Basins.

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