Coastal Plain of Orange County Groundwater Basin

- Groundwater Basin Number: 8-1
- County: Orange
- Surface Area: 224,000 acres (350 square miles)

Basin Boundaries and Hydrology

The Coastal Plain of Orange County Groundwater Basin (Orange County Basin) underlies a coastal alluvial plain in the northwestern portion of Orange County. The basin is bounded by consolidated rocks exposed on the north in the Puente and Chino Hills, on the east in the Santa Ana Mountains, and on the south in the San Joaquin Hills. The basin is bounded by the Pacific Ocean on the southwest and by a low topographic divide approximated by the Orange County - Los Angeles County line on the northwest. The basin underlies the lower Santa Ana River watershed.

Hydrogeologic Information

Water Bearing Formations

The Orange County Basin is dominated by a deep structural depression containing a thick accumulation of fresh water-bearing interbedded marine and continental sand, silt and clay deposits (DWR 1967). The proportion of fine material generally increases toward the coast, dividing the basin into forebay and pressure areas (DWR 1967; OCWD 1999b). Consequently, most surface waters recharge through the coarser, more interconnected and permeable forebay deposits. Strata in this basin are faulted and folded, and may show rapid changes in grain size. The Newport-Inglewood fault zone parallels the coastline and generally forms a barrier to groundwater flow. Erosional channels filled with permeable alluvium break this barrier at the Alamitos and Talbert Gaps, providing an opportunity for saline water to flow inland.

The sediments containing easily recoverable fresh water extend to about 2,000 feet in depth (OCWD 1999b). Although water-bearing aquifers exist below that level, water quality and pumping lift make these materials economically unviable at present (OCWD 1999b). Upper, middle and lower aquifer systems are recognized in the basin. Well yields range from 500 to 4,500 gallons per minute, but are generally 2,000 to 3,000 gallons per minute.

Upper Aquifer System. This system includes Holocene alluvium, older alluvium, stream terraces, and the upper Pleistocene deposits represented by the La Habra Formation. It has an average thickness of about 800 feet and consists mostly of sand, gravel, and conglomerate with some silt and clay beds. Generally, the upper aquifer system contains a lower percentage of water-bearing strata in the northwest and coastal portions of the area where clays and clayey silts dominate. Accordingly, recharge from the surface to the groundwater basin may be minor in these areas. Recharge to the upper aquifer system occurs primarily in the northeastern portions of the basin (DWR 1967). The upper aquifer provides most of the irrigation water for the basin (Sharp 2000; OCWD 1999a,b).

Middle Aquifer System. This system includes the lower Pleistocene Coyote Hills and San Pedro Formations which have an average thickness of 1,600 feet and are composed of sand, gravel, and minor amounts of clay. The primary recharge of the middle aquifer system is derived from the Santa Ana River channel in the northeast near the town of Olive (DWR 1967). The middle aquifer system provides 90 to 95 percent of the groundwater for the basin (Sharp 2000; OCWD 1999a,b).

Lower Aquifer System. This system includes the Upper Fernando Group of upper Pliocene age and is composed of sand and conglomerate 350 to 500 feet thick. Electric logs of this aquifer indicate that it would probably yield large quantities of fresh water to wells (DWR 1967), but it is not utilized for groundwater production at present (Sharp 2000).

Restrictive Structures

There are three fault zones within this basin that impede groundwater flow (DWR 1967). The most prominent is the Newport-Inglewood fault zone, which trends northwest and is responsible for formation of the Newport-Inglewood uplift. This fault zone forms a barrier to groundwater flow to the southwest and marks the southwest edge of the thick aquifer materials important for groundwater production in the basin (DWR 1967). This barrier is breached by erosional channels filled with alluvium at the Alamitos and Talbert Gaps. Another northwest-trending system is the Whittier fault zone which forms the northeastern boundary of the basin along the Puente Hills. This fault forms a groundwater barrier except where it is breached by recent alluvial channels (DWR 1967). The Norwalk fault trends eastward along the southern edge of the Coyote Hills and is responsible for a lower groundwater level to the south (DWR 1967).

Recharge Areas

Recharge to the basin is derived from percolation of Santa Ana River flow, infiltration of precipitation, and injection into wells. The Santa Ana River flow contains natural flow, reclaimed water, and imported water that is spread in the basin forebay (OCWD 1999a,b). Historical groundwater flow was generally toward the ocean in the southwest, but modern pumping has caused water levels to drop below sea level inland of the Newport-Inglewood fault zone. This trough-shaped depression encourages sea water to migrate inland, contaminating the groundwater supply. Strategic lines of wells in the Alamitos and Talbert Gaps inject imported and reclaimed water to create a mound of water seaward of the pumping trough to protect the basin from seawater intrusion (OCWD 1999a,b).

Groundwater Level Trends

Groundwater levels are generally lower than the level in 1969, when the basin is considered to have been full (OCWD 1999a,b). The level in the forebay has generally stabilized, whereas the southern coastal area has declined steadily through time (OCWD 1999a,b). Since 1990, the magnitude of yearly groundwater level fluctuation has approximately doubled near the coast because of seasonal water demand and short-term storage programs, but has stayed the same in the forebay (OCWD 1999a). Average groundwater levels for the Orange County Basin have risen about 15 feet

since 1990, with average levels in the forebay area rising about 30 feet and average levels in the coastal area dropping a few feet (OCWD 1999a).

Groundwater Storage

Groundwater Storage Capacity. The total capacity of the Orange County Basin is 38,000,000 AF (DWR 1967).

Groundwater in Storage. As of 1998 storage of fresh water within the basin amounted to 37,700,000 AF (OCWD 2000).

Groundwater Budget (Type A)

Orange County Water District manages this groundwater basin using a detailed model of the basin to determine potential effects of changes in pumping and recharge. The district strives to meet its water supply demand with about 75 percent groundwater (OCWD 1999b). The district operates the basin to maintain about 200,000 af of dry storage, though this fluctuates because of seasonal patterns in recharge and pumping. Average dry storage remained fairly steady during 1995 through 1998 (OCWD 1999b), but increased to more than 400,000 af by September 2002 (OCWD 2002) because of a cycle of less rainfall in the region.
Orange County Water District (2000) reports a basin inflow of 258,413 af and an outflow of 342,823 af for the 1998-1999 water year. The inflow includes natural recharge (29,434 af), artificial recharge (222,755 af), and return of applied water (6,224 af). The outflow includes non-irrigation extraction (334,136 af) and irrigation extraction (8,687 af).

Groundwater Quality

Characterization. Water within the basin is primarily sodium-calcium bicarbonate (DWR 1967). Total dissolved solids range from 232 - 661 mg/L and average 475 mg/L (OCWD 2000). The average TDS content of 240 public supply wells is 507 mg/l with a range of 196 – 1,470 mg/l.

Impairments. Sea water intrusion near the coast (DWR 1967; OCWD 1999b). Colored water, from natural organic materials in the lower aquifer system (OCWD 1999b). Increasing salinity, high nitrates and MTBE (OCWD 1999b).

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	249	1
Radiological	253	5
Nitrates	267	15
Pesticides	268	0
VOCs and SVOCs	268	7
Inorganics – Secondary	249	21

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).

[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	4 – 6,000; Average 2,020 gal/min	286 Well Completion Reports.
	Total depths (ft)	
Domestic	26-1,210; Average 270 ft	270 Well Completion Reports
Municipal/Irrigation	7-1,650; Average 540 ft	540 Well Completion Reports

Active Monitoring Data

Agency	**Parameter**	**Number of wells /measurement frequency**
OCWD	Water level	521 wells measured annually (Hintlian 2000).
OCWD	Water quality	411 wells measured 2-20 times/yr (Hintlian 2000).
Department of Health Services and cooperators	Title 22 water quality	240

Basin Management

Groundwater management:	Orange County Water District manages groundwater in the basin by authority granted to it in the California Water Code Appendix Chapter 40
Water agencies	
Public	City of Anaheim, City of Buena Park, East Orange CWD, City of Fountain Valley, City of Fullerton, City of Garden Grove, City of Huntington Beach, Irvine Ranch WD, City of La Palma, Mesa Consolidated WD, City of Newport Beach, City of Orange, Orange CWD, City of Santa Ana, City of Seal Beach, Serrano WD, City of Tustin, City of Westminster, Yorba Linda WD.
Private	Diamond Park MWC, Eastside Water Association, Harding Water, Liberty Park Water Association, Midway City MWC, McKesson Water Products, Oasis Drinking Waters, Page Avenue MWC, South Midway City WC, Southern California WC, Sparkletts Drinking Water Corporation, Woodbridge Village Homeowners Association.

References Cited

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Orange County Water District (OCWD). 1999a. Engineer's Report on Ground Water Conditions, Water Supply and Basin Utilization in the Orange County Water District.

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Sharp, Gwen. 2000. Orange County Water District. Written communication to Nuna Tersibashian. July 21, 2000.

Errata

Substantive changes made to the basin description will be noted here.