Case Study

Schlumberger WATER SERVICES

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We offer innovative groundwater solutions through professional expertise to meet the advancing technological requirements of today's professionals.

Schlumberger's Water Services division specializes in assessing, developing, and managing groundwater resources using some of the finest, advanced and cost-effective technologies available today.

Whether you're looking for field-scale data collection, data management, modeling, or resource decision-making solutions, our teams of specialists are here to help you address all your groundwater projects safely and efficiently.

Applied Technologies:

- Westbay System*
- Pressure Profiling
- Discrete Sampling
- Hydraulic Testing

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Multilevel Monitoring for Resource Management

Orange County, California

Orange County Water District facilities along the channel of the Santa Ana River

Highlights:

- OCWD manages the primary water supply to a population of more than 2 million residents
- Central to the OCWD groundwater management system are 57 Westbay System* monitoring wells that provide testing, monitoring, and sampling for approximately 550 zones
- OCWD estimated savings of 55% to 65% on construction of Westbay System wells, as compared with alternative technologies
- Westbay System provides reliable and extensive data for characterization and long-term monitoring, allowing OCWD to optimize groundwater management

Background

The Orange County Water District (OCWD) in Southern California, USA, is responsible for supplying clean water to more than 2 million residents in a 380-mi^2 [970-km^2] service area. The facilities have the capacity to recharge approximately 250,000 ac-ft [3.1x10^8 m^3] of water per year by percolation along the channel of the Santa Ana River and off-channel basins.

Groundwater supplies more than 60% of the total water demand in the area and managing this groundwater resource is the OCWD's number one priority.

Challenges

Management of groundwater over a large area is an involved process. Each year, OCWD monitors groundwater levels, production, and recharge quantities to evaluate groundwater storage changes in the basin, replenishes the basin, and conducts an assessment program to pay for operating expenses and the cost of the imported replenishment water. The district has an ongoing effort to increase available local water supplies through innovative programs such as expanding the capacity of existing percolation facilities, treating poor-quality water to make it useable, and reclaiming water.

The geology of the groundwater basin consists of alternating layers of uncemented fine- and coarse-grained sediments in a synclinal trough that plunges toward the northwest. Wellbores typically penetrate 10 to 15 different water-bearing layers over a depth of up to 1,500 ft [460 m]. By the mid-1980s, OCWD had determined that information on the piezometric level and water quality of each aquifer layer was required to optimize management of the recharge, storage, and recovery of groundwater.
Three methods of accessing the aquifer layers were considered:

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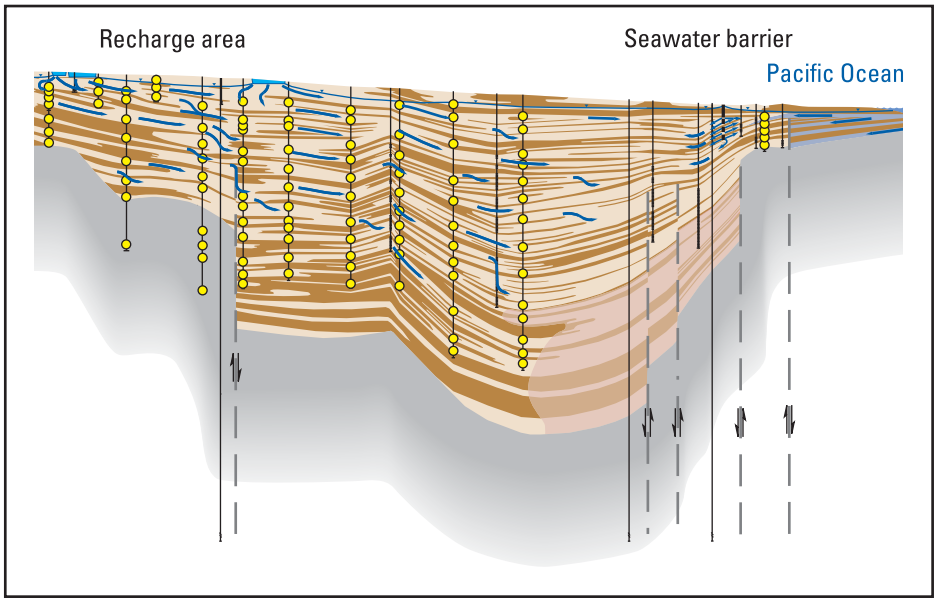
- Cluster of separate wells, with each well completed in a separate zone
- Nest of wells with up to five well casings, each completed in a separate zone, in a single borehole
- Multilevel well using the Westbay System for groundwater monitoring

Solutions

A cost analysis indicated that for 10 zones through a depth of 1,500 ft the Westbay System instrumentation would result in a total cost (including drilling, construction, and instrumentation) 55% to 65% lower than that for clustered wells or two five-well nests. OCWD selected Westbay System technology on the basis of performance and cost and in the late 1980s began a multiyear program of drilling and constructing multilevel monitoring wells throughout the basin.

Including pre-existing and new traditional single-point wells, approximately 200 monitoring wells have been established in the OCWD groundwater basin to provide the data integral to management of the resource. The focus of the monitoring network is 57 Westbay System multilevel monitoring wells, installed to depths of up to 2,000 ft [600 m]. Because each Westbay System enables measuring the water pressure, sampling for water quality, and testing hydraulic characteristics from multiple discrete zones, these 57 wells provide data equivalent to approximately 550 traditional monitoring wells. When first installed, the wells are used for characterizing the groundwater basin. Later, the same wells provide long-term monitoring data.



Groundwater monitoring improves insight into groundwater flow within the OCWD service area in Southern California.

Results

The increased data density from the Westbay System multilevel wells provides OCWD with an unprecedented definition of groundwater flow and variations in water quality. The water-level data is key to the development of three-dimensional, transient groundwater models, and the water quality data provides information on the movement of recharge water and identifies areas with poor-quality water to avoid and mark for future remediation. This insight into water quality is used in designing new production wells to avoid the undesirable water. Without the aid of this detailed monitoring network, the district could not model the groundwater basin with the degree of confidence it currently has. The groundwater models are the basis for a long-term management plan that encompasses maximizing the sustainable pumping capacity of the basin. Under consideration is the development of inland well fields and additional recharge facilities to support a higher operable yield. Total groundwater production is currently approximately 320,000 acre-ft [3.95×10^8 m^3] per year. The extensive, detailed data collected with Westbay System instrumentation makes it evident that the implementation of new programs and projects can increase the annual groundwater production to more than 450,000 acre-ft [5.55×10^8 m^3] per year.

OCWD recognizes that there are distinct major phases to optimizing groundwater management: detailed characterization and monitoring, interpretation and evaluation of the data collected, and planning future management of the resource. The phases must be followed sequentially. There are no shortcuts—detailed characterization and monitoring are the foundation for effective basin management decisions. Westbay System multilevel monitoring systems provide the key data for a sound foundation.

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