U.S. Geological Survey Deep-Aquifer Monitoring-Well Site, Marina, California

by R. T. Hanson

The U.S. Geological Survey **(USGS)**, in cooperation with the Monterey County Water Resource Agency, has completed a multiple-well monitoring site (DMW1) in the deep-aquifer system in the coastal area of Marina, California (fig. 1). The site was installed to monitor potential seawater intrusion between Monterey Bay and the nearby Marina Coast Water District (MCWD) water-supply wells No. 10, 11, and 12 (fig. 1). The site also provides local water agencies basic information about the geology, hydrology, and geochemistry of the deep-aquifer system.

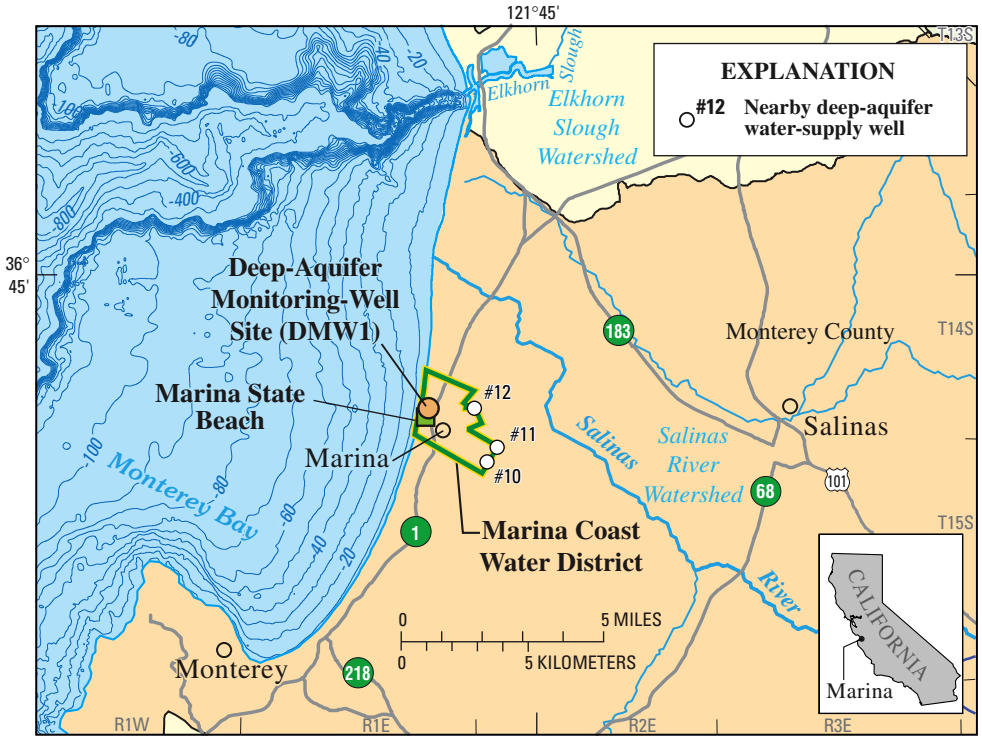

Figure 1. Location of deep-aquifer monitoring-well site and selected water-supply wells Marina, California.

WELL COMPLETION

The DMW1 borehole was drilled to a depth of 2,012 ft below land surface. The DMW1 multiple-well monitoring site contains four wells screened at 930 to 950 feet, 1,040 to 1,060 feet, 1,410 to 1,430, and 1,820 to 1,860 feet below land surface (fig. 2). These depths were chosen to span the screen depths of nearby MCWD water-supply wells that range from depths of about 900 to 2,000 feet below land surface.

NEW INFORMATION ABOUT THE DEEP-AQUIFER SYSTEM

(1) The geologic and geophysical data indicate that there are multiple layers of coarse- and fine-grained sediments (fig. 2) throughout the depth penetrated by the borehole. Layers of fine-grained deposits increase in occurrence below a depth of 700 ft. (fig. 2).

(2) Water samples from three of the monitoring wells have chloride concentrations less than 155 mg/L (table 1). The sample from the DMW1-3 well had a chloride concentration of 10,800 mg/L and a total dissolved-solids concentration of 23,840 mg/L (table 1). However, the data from this site are insufficient to determine the areal extent of this saline water.

(3) The absence of tritium in samples from the DMW1 wells indicates no recent (<50 years old) recharge is present in the ground water sampled at the monitoring-well site. Uncorrected carbon-14 ages indicate the ground water represents recharge that occurred tens of thousands of years before present (table 1). Corrected carbon-14 ages (not shown) can be as much as 30 percent younger due to the addition of inorganic carbon to the ground water (Davis and Bentley, 1982).

(4) The carbon-14 data indicate that there is no recent seawater in the ground water sampled at the monitoring-well site. Additional investigation is required to determine the source or sources of this saline water in DMW1-3. Possible sources may include ancient seawater, deep marine brines, evaporative salts, and saline water from adjacent marine clays.

(5) Water levels in the DMW1 monitoring wells are below sea level (fig. 2). If the zones are hydraulically connected to Monterey Bay, there is the potential for seawater intrusion.

(6) The major-ion chemistry (fig. 3) indicates that the water samples from the MCWD deep-aquifer water-supply wells and the nonsaline monitoring wells (DMW1-1, -2, and –4) are chemically similar. Well DMW1-3 is different from the MCWD water-supply wells because of an increased percentage of chloride and magnesium concentration. (fig. 3)

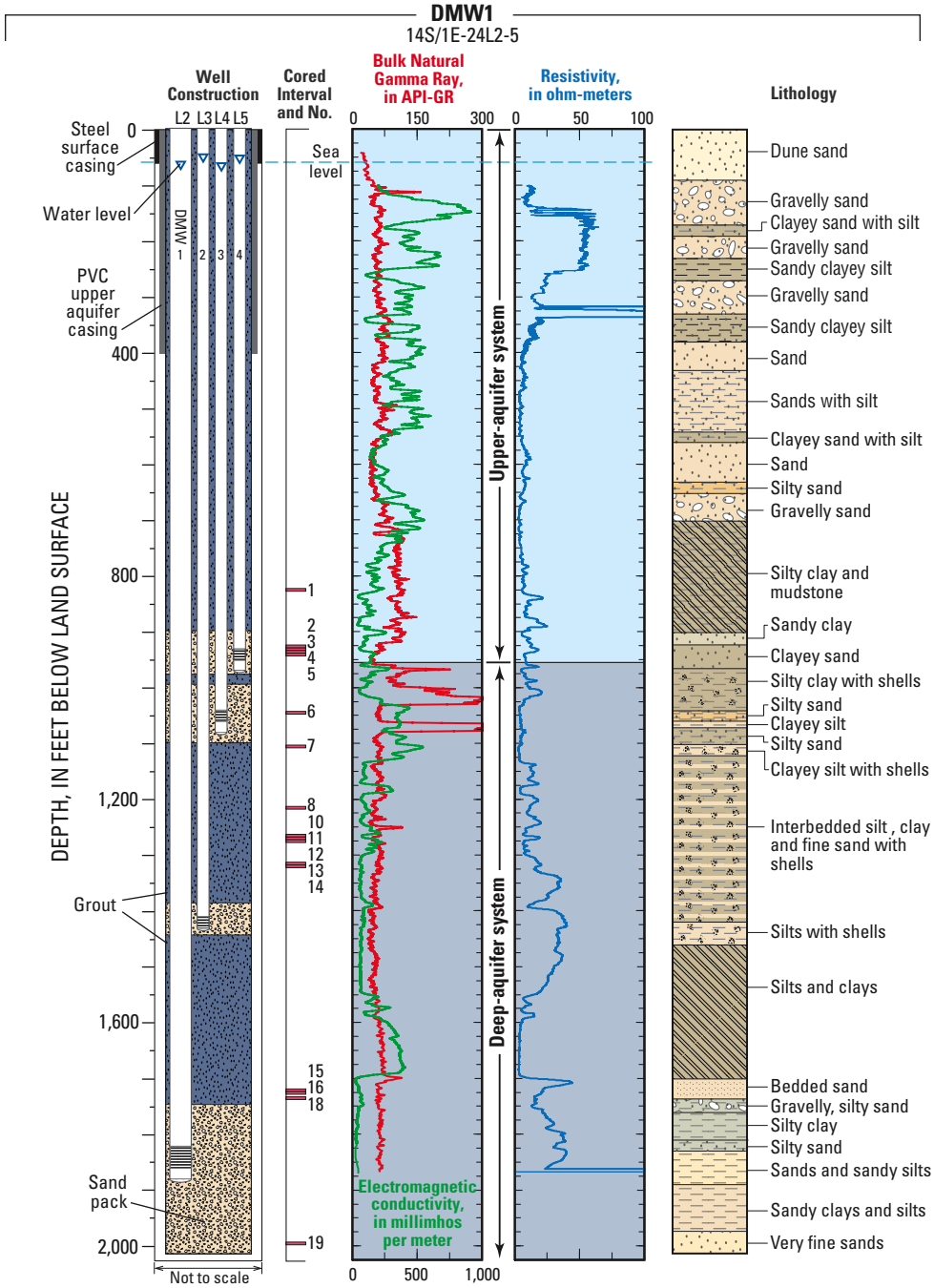

Figure 2. Deep-aquifer monitoring well (DMW1) construction, cored intervals, geophysical logs, aquifer systems, and lithology, Marina, California.

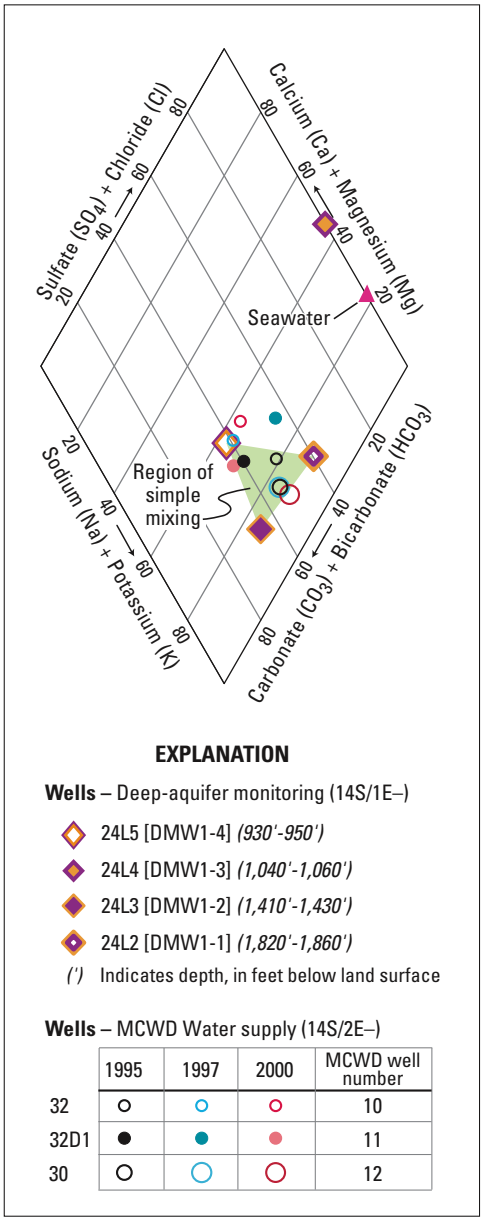

Figure 3. Chemical composition of major ions in ground-water from the deep-aquifer monitoring well (DMW1) and other nearby water-supply wells, Marina, California.

Table 1. Selected water-chemistry constituents for the DMW1 monitoring site.

Local Well Number	Screened Interval (feet below land surface)	Chloride (mg/L)	Total Dissolved Solids (mg/L)	Uncorrected Carbon-14 age (years before present)
DMW1-4	930-950	69	417	31,000
DMW1-3	1,040-1,060	10,800	23,840	28,800
DMW1-2	1,410-1,430	48	318	22,000
DMW1-1	1,820-1,860	150	506	25,900

REFERENCES CITED:

Davis, S.N., and Bentley, H.W., 1982, Dating groundwater, a short review, in Currie, L.A., ed., Nuclear and chemical dating techniques–Interpreting the environmental record: American Chemical Society Symposium Series, v. 176, p. 187-222.

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