WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

Technical Bulletin

Volume 7 ~ Spring 2006

INSTALLING A WATER SUPPLY WELL IN THE CENTRAL AND WEST COAST BASINS - USING AVAILABLE GEOLOGIC INFORMATION TO PREDICT HOW DEEP TO DRILL

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Many of the issues and costs of installing a Water Supply Well were presented in Technical Bulletin, Volume 5. The purpose of this Technical Bulletin is to provide the types and sources of hydrogeologic information available on the Central and West Coast Basins (CWCB) before beginning a drilling program.

The decision on how deep to drill and construct a well involves many considerations and it is important to review and analyze available information during the planning stages. There are many advantages to drilling deeper, but increasing depth also increases costs. Water quality considerations, which also influences drilling depth, will be presented in a future Technical Bulletin.

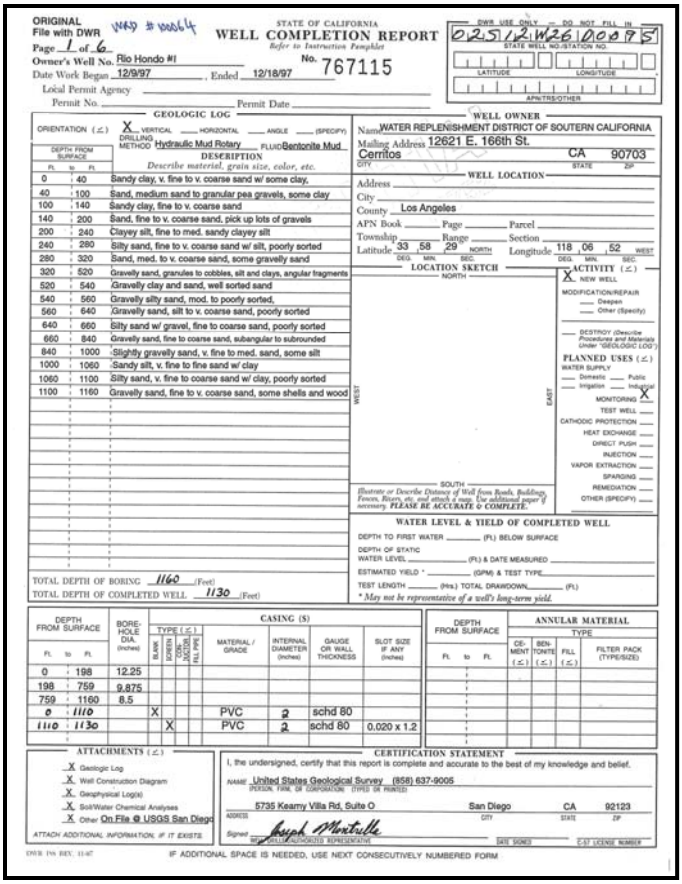
By researching available information first, preparations can be made in advance to improve the likelihood of constructing a successful new water supply well. Information can be obtained from many sources including WRD, the State of California Department of Water Resources, University and public libraries, and the pumping community. WRD staff has worked extensively to research, archive and interpret various geologic and other data and can serve as a resource.

Geologic Considerations

As discussed in Technical Bulletin, Volume 1, the CWCB are comprised of unconsolidated sediments underlain by older consolidated sediments and bedrock. The sediments are geologic materials ranging from coarse gravels and sands to fine grained silts and clays. The gravels and sands can be massive, thick, and extend to the ground surface; or they can be inter-layered with the finer silts and clays as in the pressure areas. Significantly thick water yielding sands and gravels are designated aquifers. Finding and tapping the aquifers in order to construct a successful well at a specific location can be reasonably predicted using a variety of geologic information.

The various types of information which summarize useful lithologic information include boring/drilling logs, geophysical logs, cross-sections, and structural contour maps. WRD has drilled over 40 deep monitoring wells in the CWCB and detailed borehole log and geophysical log information from these wells are available. In California, well completion reports from water supply wells are confidential and permission to use them must be obtained from the well owner. Hydrogeologic cross-sections and structural contour maps of CWCB aquifers are presented in various publications. Especially useful is the State of California Department of Water Resources *Bulletin No. 104: Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County-Appendix A Groundwater Geology,* published in 1961.

Borehole logs are depth specific descriptions of the geologic materials encountered at a drilling location. Borehole logs may stand alone but are often included as part of a Well Completion Report like the one shown below. During the drilling of a borehole for a soil boring, monitoring well, or water supply well, geologic materials are collected at intervals from the ground surface to the total depth of the borehole and described by a geologist, engineer or well driller. Sampling methods and the quality of descriptions vary widely based on the level of effort and qualifications of the person logging the data. Descriptions can range from as



ORIGINAL File with DWR — WCR # 10864

STATE OF CALIFORNIA — WELL COMPLETION REPORT — Refer to Instruction Pamphlet — No. 767115

Page 1 of 6 — Owner's Well No. Rio Hondo #1 — Date Work Began 12/9/97 — Ended 12/18/97

Local Permit Agency — Permit No. — Permit Date

DWR USE ONLY — DO NOT FILL IN — 025/12W26D00875 — STATE WELL NO./STATION NO. — LATITUDE — LONGITUDE — APN/TRS/OTHER

GEOLOGIC LOG — ORIENTATION (∠) X VERTICAL — HORIZONTAL — ANGLE — (SPECIFY) — DRILLING METHOD Hydraulic Mud Rotary — FLUID Bentonite Mud

DEPTH FROM SURFACE ft.	to ft.	Describe material, grain size, color, etc.
0	40	Sandy clay, v. fine to v. coarse sand w/ some clay,
40	100	Sand, medium sand to granular pea gravels, some clay
100	140	Sandy clay, fine to v. coarse sand
140	200	Sand, fine to v. coarse sand, pick up lots of gravels
200	240	Clayey silt, fine to med. sandy clayey silt
240	280	Silty sand, fine to v. coarse sand w/ silt, poorly sorted
280	320	Sand, med. to v. coarse sand, some gravelly sand
320	520	Gravelly sand, granules to cobbles, silt and clays, angular fragments
520	540	Gravelly clay and sand, well sorted sand
540	560	Gravelly silty sand, mod. to poorly sorted,
560	640	Gravelly sand, silt to v. coarse sand, poorly sorted
640	660	Silty sand w/ gravel, fine to coarse sand, poorly sorted
660	840	Gravely sand, fine to coarse sand, subangular to subrounded
840	1000	Slightly gravelly sand, v. fine to med. sand, some silt
1000	1060	Sandy silt, v. fine to fine sand w/ clay
1060	1100	Silty sand, v. fine to coarse sand w/ clay, poorly sorted
1100	1160	Gravelly sand, fine to v. coarse sand, some shells and wood

TOTAL DEPTH OF BORING 1160 (Feet) — TOTAL DEPTH OF COMPLETED WELL 1130 (Feet)

WELL OWNER — Name WATER REPLENISHMENT DISTRICT OF SOUTERN CALIFORNIA — Mailing Address 12621 E. 166th St. — Cerritos — CA — 90703

WELL LOCATION — Address — City — County Los Angeles — APN Book — Page — Parcel — Township — Range — Section — Latitude 33 58 29 NORTH — Longitude 118 06 52 WEST

LOCATION SKETCH — NORTH — WEST — EAST — SOUTH — Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (∠) — X NEW WELL — MODIFICATION/REPAIR — Deepen — Other (Specify) — DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG") — PLANNED USES (∠) — WATER SUPPLY — Domestic — Public — Irrigation — Industrial — X MONITORING — TEST WELL — CATHODIC PROTECTION — HEAT EXCHANGE — DIRECT PUSH — INJECTION — VAPOR EXTRACTION — SPARGING — REMEDIATION — OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL — DEPTH TO FIRST WATER — (Ft.) BELOW SURFACE — DEPTH OF STATIC WATER LEVEL — (Ft.) & DATE MEASURED — ESTIMATED YIELD * — (GPM) & TEST TYPE — TEST LENGTH — (Hrs.) TOTAL DRAWDOWN — (Ft.) — * May not be representative of a well's long-term yield.

DEPTH FROM SURFACE ft.	to ft.	BORE-HOLE DIA. (inches)	CASING (S) TYPE (∠) BLANK	PERFOR.	CONT. SLOTTED	BLANK	MATERIAL / GRADE	INTERNAL DIAMETER (inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (inches)
0	198	12.25								
198	759	9.875								
759	1160	8.5								
0	1110		X				PVC	2	sch 80	
1110	1130				X		PVC	2	sch 80	0.020 x 1.2

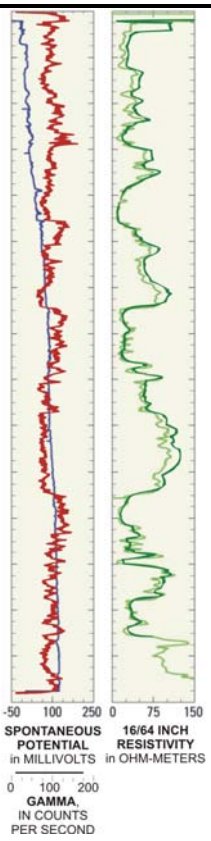
DEPTH FROM SURFACE ft.	to ft.	ANNULAR MATERIAL TYPE (CEMENT (∠))	(BENTONITE (∠))	(FILL (∠))	FILTER PACK (TYPE/SIZE)

ATTACHMENTS (∠) — X Geologic Log — X Well Construction Diagram — X Geophysical Log(s) — X Soil/Water Chemical Analyses — X Other On File @ USGS San Diego — ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT — I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief. — NAME United States Geological Survey (858) 637-9005 (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED) — ADDRESS 5735 Kearny Villa Rd, Suite O — San Diego — CA — 92123 — Signed Joyal Mastella (SIGNATURE REPRESENTATIVE) — DATE SIGNED — C-57 LICENSE NUMBER

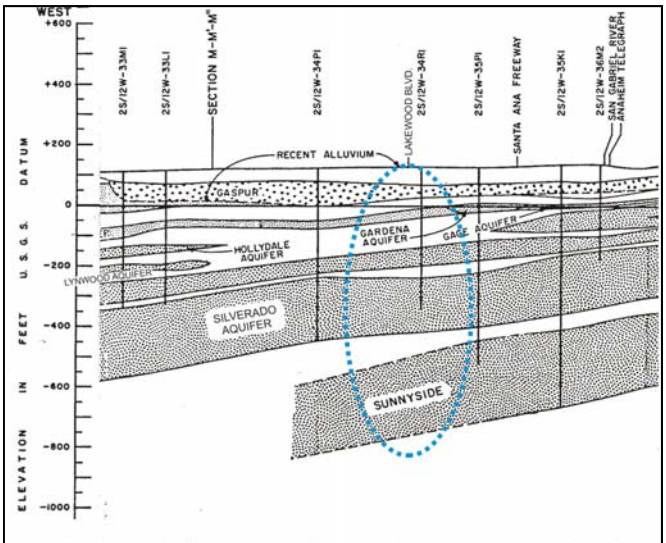
DWR 188 REV. 11-97 — IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

simple as “from 275 to 300 feet: Sand” to highly detailed descriptions of grain-size, color, sedimentary structure, and fossil assemblage. Most water supply wells, monitoring wells, and oil wells have a borehole log which was prepared during drilling.



Geophysical logs are often produced along with borehole logs. These logs are plots of various types of measurements of the physical properties of the geologic materials and groundwater in the borehole. The measurements are made by lowering instruments down the borehole and are plotted by depth starting from the top and continuing downwards. The sample at the right shows the most common geophysical logs including gamma ray, spontaneous potential and electrical resistivity. Generally, higher resistivity indicates coarser geologic materials and higher gamma and spontaneous potential indicate finer materials. There are other types of geophysical logs, many developed for oil exploration. Although geophysical logs are complicated and requires interpretation by a geologist or engineer, they can provide invaluable information in planning and constructing a well.

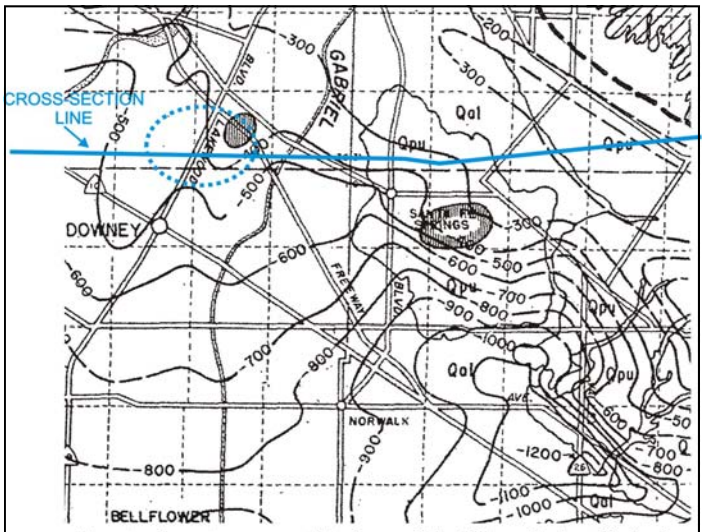
Cross-sections may be the easiest tool to help visualize the geologic subsurface. The depths to tops and bottoms of aquifers and aquitards are easily seen. Scales indicating depths and/or elevations are provided along with some surface features.



Hydrogeologic cross-section running west to east though the Downey/Santa Fe Springs area. Sand and Gravel Aquifer (stippled) Are Shown Separated by silt and clay Aqitards (white)

Cross-sections are built from nearby borehole and geophysical logs along straight or sometimes segmented lines on a map. The example above shows a portion of a geologic cross-section through the Downey/Santa Fe Springs area. Local aquifers are shown and provide an indication of the depths where water might be encountered.

Structural contour maps in CDWR Bulletin 104 include thicknesses and base elevations of the main aquifers in the CWCB. The maps can be used to determine the approximate depths to the tops and bottom of aquifers at a location, especially when there is no cross-section nearby. The structural contour map below illustrates a portion of the elevation contours of the base of the Silverado Aquifer in the Downey/Norwalk/Bellflower area. A location is indicated at



Structural contour map of the base of the Silverado Aquifer in the Downey/Norwalk Bellflower area (CDWR Bull. 104). Dotted blue area indicates an elevation of base of Silverado Aquifer at around 400 feet below sea level.

the intersection of Lakewood Boulevard and Interstate 5 which is very near a contour line with a value of 400 feet below mean sea level (an approximate depth of 525 feet).

Summary

By locating and utilizing existing geologic information available on the CWCB, significant predictions can be made regarding planning the depth of drilling and the construction design of a new water supply well. This information may also help with determining a location, developing bid specifications, and selecting a drilling method for a well. WRD hydrogeologists and engineers can assist in identifying and interpreting relevant information discussed in this Bulletin.

Well logging and zone testing techniques have advanced over recent years. Additionally, oil field technologies have been transferred and applied to the groundwater supply industry and can be used to supplement the traditional information.

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