USING HYDROPHYSICAL AND GEOPHYSICAL LOGGING TO OPTIMIZE WATER SUPPLY WELL PRODUCTION AND COST

Water supply wells are expensive to design, construct and maintain. Achieving high well yield and good water quality are primary objectives of any water supply well design. Often, agricultural and livestock supply wells are 'designed' based on local aquifer knowledge, or assumptions based on existing, but remote wells. With the objective of saving money, new wells may be constructed similar to older nearby wells, without the benefit of detailed, relevant hydrogeologic data from geophysical or hydrophysical logging.

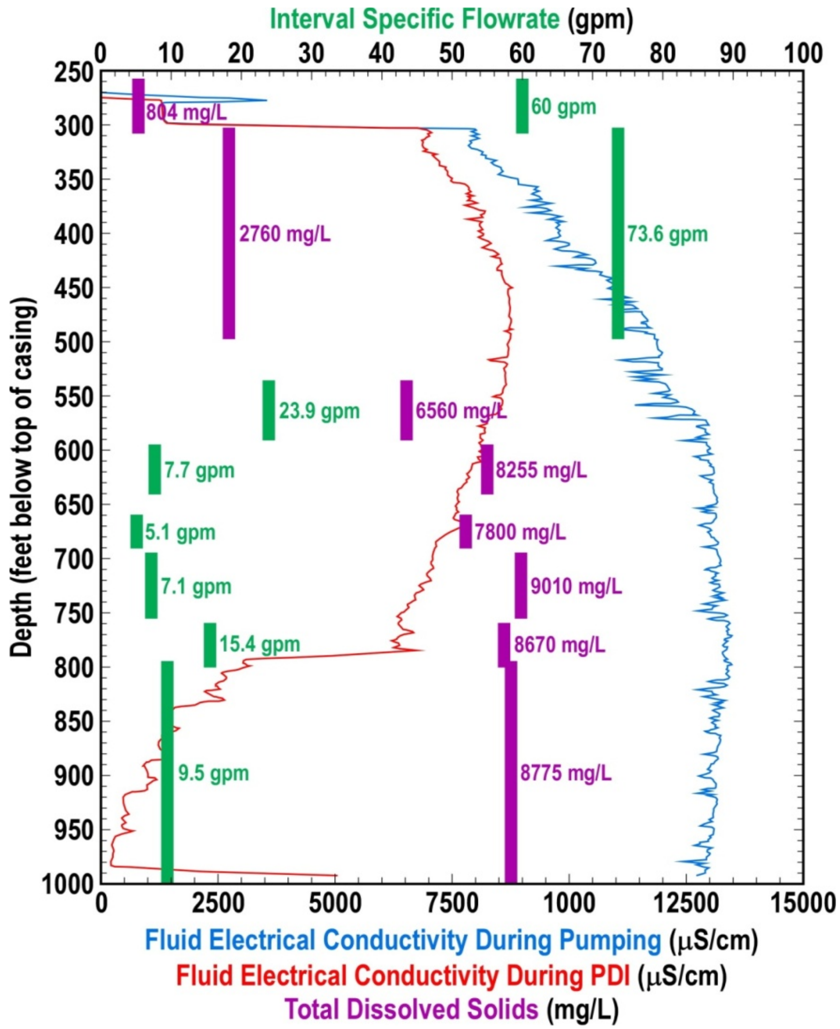
In this case, a well intended as a high yield agricultural supply well was drilled to a pre-determined depth, as based on (inaccurate) assumptions about a highly heterogeneic hydrogeologic environment. The saturated interval (from about 225 feet to 1,000 feet) was fully-screened using the 'deeper is better' well design philosophy. Pump testing at 202 GPM with 17 feet of drawdown, suggested a high-yield well with a Specifc Capacity of 17 gpm/foot. However, during development pumping, water quality was very poor with TDS of approximately 7,800 mg/L, effectively rendering the well useless for its intended purpose.

RAS effectively applied hydrophysical and geophysical logging and discrete-depth fluid sampling (during pumping) to determine the locations of water bearing intervals, in-situ flow direction, flow velocity, vertical water quality distribution, including TDS, and to estimate the interval specific hydraulic conductivity.

The results suggested that the lower zones had the lowest water quality and also the lowest interval-specific yield, while the upper zones had better water quality and higher yield. On the reverse, Figure A presents the relevant hydrophysical logging data: final pumping Fluid Electrical Conductivity profile, final dilution FEC profile, interval specific TDS and interval specific flow rate. Interval specific TDS ranged from 804 to 8,775 mg/L and interval specific flow ranged from 5.1 to 73.6 gpm.

From these data, RAS recommended that the lower 500 feet of the well be grouted as presented in Figure B. Sealing the lower six conductive features in this well resulted in the recovery of 133 gpm of the original 200 gpm (a 34% reduction in yield) at a TDS of 1,875 mg/L (a 64 % reduction of TDS). The reduction in TDS expanded the range of uses for agricultural and livestock supply, and allowed potential use of this well as a source for blended municipal supply.

Conducting a suite of hydrophysical and geophysical logging prior to construction would have saved serious money, because the well could have been completed to a much shallower depth, with better, higher quality production.



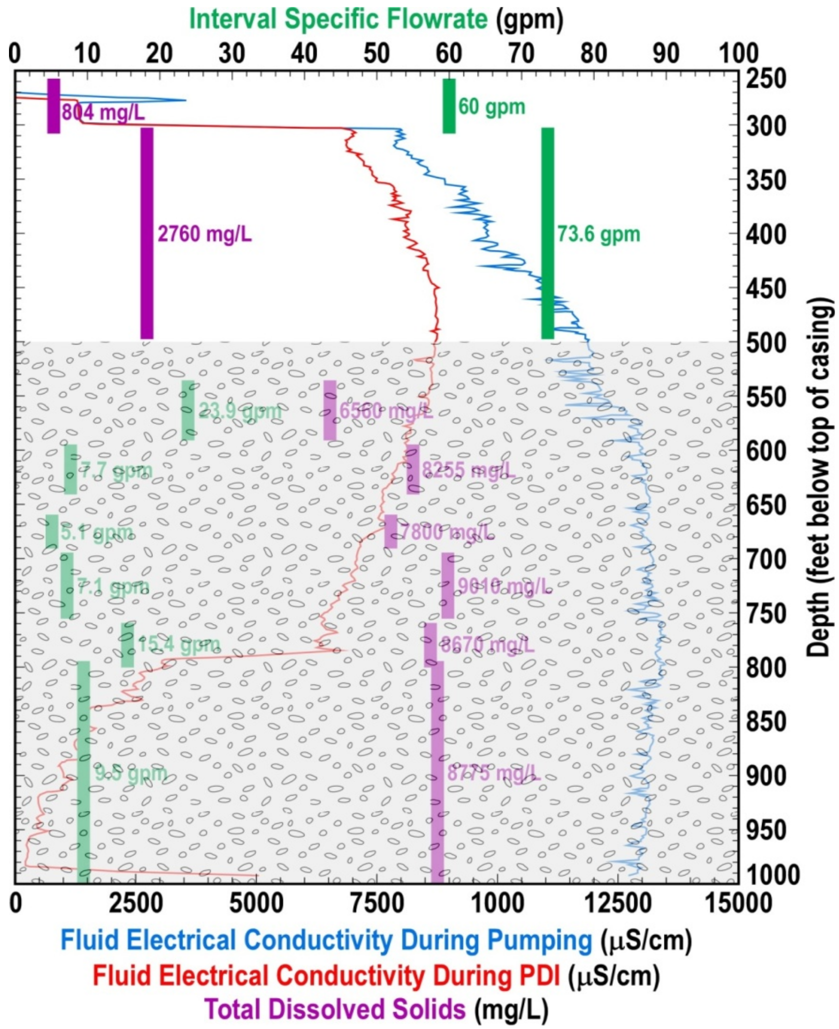


Figure A - The results suggested that the lower zones had the lowest water quality and also the lowest interval-specific flow rate, while the upper zones had better water quality and higher yield. Total well depth could have been shallower with reduced cost and improved production.

Figure B - RAS recommended that the lower 500 feet of the well be grouted. The grouted well produced 133 gpm at a TDS of 1,875 mg/L - a 64% reduction of TDS with only a 34% reduction on yield.