SOLINST TECHNICAL BULLETIN

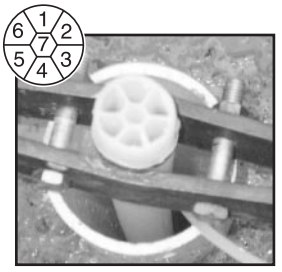
Advances in Multilevel Well Technology

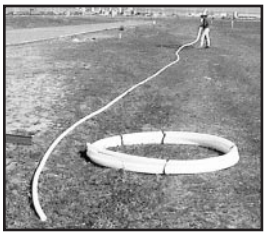
Introduction

Several detailed field studies performed at research sites in the 1980's and 1990's suggest that most contaminant plumes exhibit large variations in concentration over small vertical distances. These variations are caused by spatial variations in the contaminant source zones and heterogeneity of the geologic materials. Conventional monitoring wells have been shown to be ineffective for accurately defining the distribution of contaminants in most aquifers because of the mixing that occurs in the wells when they are pumped. Nested or clustered monitoring wells (i.e., two or more individual wells installed to different depths in the same borehole) have been used at some sites. However their use is discouraged by many government regulatory agencies because of the difficulty in installing reliable seals between the various monitored zones.

Continuous Multichannel Tubing (CMT)

The CMT Multilevel Monitoring System represents an important advancement in our ability to accurately characterize the distribution of dissolved contaminants. CMT tubing is manufactured with internal partitions, forming seven 0.5-inch-diameter channels within the tubing. This "honeycomb" design creates seven discrete "wells" within a single length of tubing. Unlike nested wells, a CMT well is comprised of one long tube equal in length to the depth of the deepest monitoring zone. This facilitates the installation of reliable annular seals between monitoring zones in unconsolidated sediments and in bedrock. CMT tubing is stocked in lengths up to 300 feet, and is cut in the field to suit the installation.



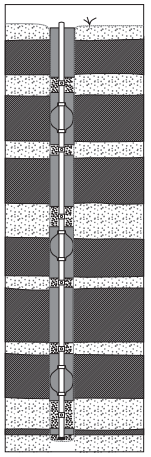


Preparation

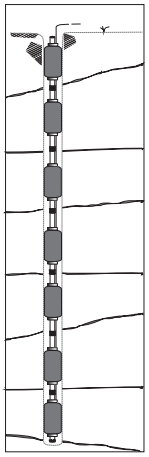
Before installation, ports are created in the various channels at the desired depths using an indexed cutting tool. Mechanical plugs are used to seal the various channels below each monitoring port. The ports are then covered with fine stainless steel mesh to prevent sand from entering the ports when water is pumped from the channels during sampling.

Installation Methods

In loose, unconsolidated sand and/or gravel formations, CMT wells can be quickly installed by inserting the tubing (with ports and well screens) into the ground through a temporary steel casing and then retracting the casing. This is the primary method of installing CMT wells with direct push (DP) sampling equipment. In clay-rich or indurated sediments, the borehole usually will not collapse and it becomes necessary to seal the annular space between the various intake ports. At these sites, alternating lifts of sand and bentonite can be added from the ground surface using conventional well construction techniques (i.e. backfill method). Low-profile tubing centralizers have been developed to keep the CMT tubing centered in the borehole during well construction. Double-acting inflatable packers are available for sealing boreholes drilled into fractured bedrock. The packers can be deflated and the CMT wells removed when they are no longer needed.



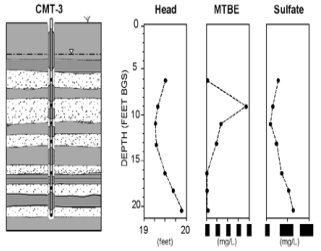
Installation in unconsolidated sediments



Installation in fractured bedrock.

Collecting Samples and Measuring Water Levels

Water samples can be collected using peristaltic pumps or inertial pumps. The depth to water can be measured in each channel with small-diameter water-level tapes. Small-diameter pressure transducers are also available for automated level monitoring, facilitating continuous monitoring of water levels during hydraulic tests, or long-term monitoring in conjunction with regional aquifer studies.



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Solinst Canada Ltd., 35 Todd Road, Georgetown, ON L7G 4R8 Fax: (905) 873-1992; (800) 516-9081
Web: www.solinst.com E-mail: instruments@solinst.com Tel:(905) 873-2255,(800) 661-2023