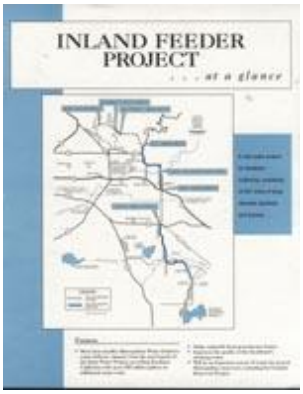
Project: Deep Ground Water Monitoring
Client: So. California Municipal Water District
Location: San Bernardino, California
Year: 1998

Application Notes:

The inland feeder project is composed of a network of water delivery pipes and canals that will bring water from the Eastside Reservoir to the Los Angeles area. The Metropolitan Water District had contracted Bectel as the prime contractor for the project. Bectel in turn subcontracted various aspects of the project to other consulting firms. PSOMAS & Associates was contracted to monitor several deep ground water wells along the area where a large water delivery tunnel was being drilled through the mountains east of Los Angeles, California. After months of monitoring these wells by hiking to the sites and recording the water levels, the drilling was preparing to start, and it was decided that it would be critical to have a real-time monitoring system in place that could provide data on the wells around the clock, and should the need arise, it would alarm the personnel at Metropolitan Water District if it appeared that the tunneling had created a leak in the underground water table. The goal was to drill the tunnel without disturbing the existing hydrology.

All of the instrumentation and equipment had to be hauled in each site by helicopter.



Installation and System Design:

PSOMAS contracted with Intermountain Environmental to provide instrumentation and installation services for seven monitoring sites. Access to the sites could only be made by helicopter. Each site was similar except that some sites had two piezometers.

A crew from the Southern California Metropolitan Water district went into each site first and installed a concrete box and a 15 ft. x 2" pole. Intermountain Environmental personnel followed behind and installed the instrumentation. This included a fiberglass enclosure that housed a CR10X Data logger, a COM100 Cellular Phone Package with a COM 200 Phone Modem, and an AVW1 or AVW4 Vibrating Wire Interface Module depending on the number of piezometers that were to be monitored by the data logger. The piezometers were Geokon Series 4500 Vibrating Wire Pressure Transducers. These had been previously installed in the wells, and the wells had been grouted so that the water table and pressure would remain the same as previous to the time the borehole was made. The transducers were installed from 500 to over a 1000 ft. deep.

Concrete Box with 100-amp hour deep cycle battery and enclosure with data logger, cellular phone modem package, and vibrating wire interface module.

In order to allow the cellular phone system to remain in a powered up state during as many hours of the day as possible, a 20-watt solar panel was used to recharge a 100 Amp hour deep cycle battery. This allows the cellular system to remain available for about 12 hours of the day. The battery was installed in the concrete box along with the data logger enclosure.

The fiberglass enclosure was custom designed by DACOM Technologies with military twist-on type connectors so that the sensors, power, and antenna cables, could be quickly removed from an enclosure and replaced with a complete spare data logging unit if for some reason there was a need.

Helicopter time is very expensive, so it was critical that the stations were designed to go in quickly. In a period of four days, Intermountain Environmental personnel with the assistance of a local helicopter pilot were able to install instrumentation on all seven sites.

Intermountain Environmental working into the evening hours to complete the per smell project.

Post Installation Notes:

SCMWD personnel had tested the cellular path to each site by using a hand held phone and confirming communication from each site. It was initially decided to use Omni directional antennas and take advantage of the possibility of using multiple cellular repeaters to increase the odds of getting through even during very busy times of cellular usage. However, on several sites it was found that data transmission was not possible unless a YAGI directional Antenna was located at a higher elevation and pointed directly at a single cellular transmission tower. Configuring a remote data collection cellular network is highly dependant on the cellular provider, and the reliability of any site can change based on the cellular providers operational decisions.

After the initial installation and testing we found that a couple of the sites were not reading correctly. On a quick return visit to these sites we found that the cable splices that had been made had partially failed. These were repaired and the systems were again up and operating. Splicing cables can be very tricky, and even more so in the field. We found that the use of solder splice joints was more effective than using a butane soldering iron. The splicing joints cost about $1.00 each but the time saved and the resultant reliability are well worth the cost. It was found that using adhesive lined heat shrink-wrapped with self-fusing tape work well for joints that are going to be buried. Several weeks after finalizing the installation SCMWD found that occasionally they were getting some measurement spikes from a couple of the sites. These spikes would cause the alarms to go off and create a momentary period of trauma for the personnel monitoring the sites. They would then check the site using real-time connections and find that the measurements were not in the alarm window. Through cooperation with Campbell Scientific it was learned that the length of the cable runs and the way the sensors were installed in the borehole required us to slightly alter the standard programming setup of the piezometers. Additionally we modified the measurement routine to look at several simultaneous measurements before recording the measurement to final storage. This allowed the data logger to ensure that the measurement was valid and not a random spike.

In 2001 SCMWD personnel, following the design that had been laid out by Intermountain Environmental, added eight more sites to the network. The systems had been so reliable for the previous 3 years, that rather than purchase another data logging system, for one of the new sites, SCMWD decided to use the unit that they had been keeping as a spare.

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