

# Deep-well Groundwater Sampling

## Lower-cost Sampling from Depths to 1 Kilometer



[www.qedenv.com/deepwell](http://www.qedenv.com/deepwell)

## **The Deep-well Challenge: Extreme Sampling at a Depth of 1 Kilometer**

QED Environmental Systems has recently been working with mine operators to sample a coal seam fracking site in Australia. Samples must be collected from more than 3,500 feet below the surface. The water is significantly hotter than the usual groundwater site, adding complications. Sampling is performed by a dedicated bladder pump located at a depth of 300 feet; water is brought up to that level from the deep coal seam via a drop tube under hydrostatic pressure. The system is equipped with Teflon tubing to withstand the high temperature of the sampled water; a stainless steel cable provides additional support for the downwell components.



*Cortez Gold Mine, Lander County, Nevada.*

Not every site presents such extreme challenges. Deep-well sampling is generally defined as any groundwater quality sampling application where samples are needed from deeper than 250 feet, requiring:

- A pump model that is rated for operation at 120 psi or higher pressures (required to bring samples to the surface while pumping against a deeper water column)
- Air and liquid discharge tubing with the same high pressure rating
- A pump controller rated for these higher required operational pressures

The need for collecting groundwater samples at these depths occurs very frequently in the arid western U.S. and Australia, and in mountainous areas such as Hawaii.



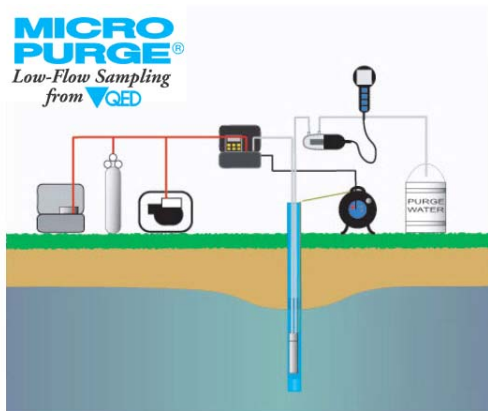
*Dedicated QED deep-well sampling system being installed to 970 feet at high-elevation Nevada gold mine.*

Historically, sampling systems and methods for monitoring deep groundwater conditions have required elaborate, expensive approaches because of the requirement to purge multiple volumes from the well prior to sample collection. This high-volume purging method also has the potential to mobilize particles from the sediment, meaning samples are not representative of the true groundwater conditions, and false positives in the analytical data can cause compliance issues. Collection and disposal of purge water add to the cost of this approach; some wells can generate hundreds to thousands of gallons of purge water, and require numerous labor hours from multi-person crews. It is not uncommon with this conventional sampling approach to see costs for sampling a single deep well run to \$15,000 or more per well, per sampling event.



*Typical Smeal rig required for deep-well Electrical Submersible Pump [ESP] sampling equipment operations.*

In deep-well sampling, numerous technical aspects go into the system design itself, but system installation can also be very demanding. Using a portable electrical submersible pump (ESP) for sampling deeper wells is extremely labor intensive, and prone to mishaps and handling issues. Due to the ESP system weight, it requires the use of a Smeal rig to lower the pump down the well without getting it tangled on hundreds of feet of multiple tubing and lines, some of them electrical. After sampling, all of that has to be pulled back up the well without getting it stuck or cross-contaminating the system or sample. ESPs are also prone to operational issues caused by overheating – especially when using low-flow sampling protocols at deeper pump depths.



## **QED Low-flow Sampling Components Make Your Installation a Success**

QED's dedicated, low-flow sampling pumps give any system, but especially deep-well systems, a more cost effective approach while also affording better data accuracy and precision. With dedicated equipment, once the pump is placed in the well, there is no pulling and resetting of the system. With low-flow sampling methods, sediment is not mobilized, eliminating the risk of false positives. QED deep-well sampling systems have been installed at many sites, with some sampling zones to >3,000 feet below ground surface (pump depths to 1,200 feet). This has afforded the operators more precise sampling data as well as significant savings in operational time, effort, and cost.

Changing over to low-flow sampling from the old method of three-volume purging reduces disposed volumes of purge water by up to 95%, and labor costs at some sampling sites can be cut by 80%. Some deep-well sites that previously took a sampling crew 10+ working hours can now be sampled in less than 1 to 2 hours by a single technician.



***Dedicated Well Wizard sampling near LAX International Airport taxi way with QED portable MicroPurge<sup>®</sup> integrated surface controls.***

QED is the only manufacturer that offers standard models in a complete range of materials to survive the harsh downwell conditions often encountered at mining sites and other deep-well sampling applications, including 316 electro-polished Stainless Steel, PVC, or even all-Teflon (for shallower wells). With dedicated equipment, there is no need for a trailer with a pump and generator, or 1,000 feet of extra line – all that's required is a nitrogen gas cylinder (or a portable compressor for pump depths <250 feet), a pump controller, water level meter and a water analyzer/flow cell. QED also offers MicroPurge<sup>®</sup> equipment, a complete, integrated system of controllers and accessories for low-flow sample collection.

All QED MicroPurge Pump Controllers (U.S. Patent Number 6,508,310) include built-in safety features including pressure relief valves and quick-connect fittings rated for the unit's maximum operational pressures. QED controllers come in three standard pressure ranges:

- The standard MP10 model is rated to a maximum operational depth of no more than 250 feet.
- Wells deeper than 250 feet require the high pressure MP10H controller that is rated for operational pump depths up to 500-600 feet.
- Sampling from deeper than 600 feet requires the use of the ultra-high pressure MP10UH controller model, operational to depths of 600-1,200 feet.

QED's MicroPurge® MP20 Water Analyzer and Flow Cell (U.S. Patent Number 6,415,659) is part of the integrated system, and allows measurement and logging of complete field parameters without introducing oxygen or any artifacts into the purging process. It includes the exclusive Purge Scan™ software, which not only allows you to electronically collect/store well data, but also back calculates through previous data sets to determine if purging has reached parameter stabilization. QED also offers the MP30 Water Level and Drawdown Meter (U.S. Patent Number 6,456,201), which monitors for any excessive drop in water level, and both alerts the user to this and automatically pauses pump operation.

QED utilizes only high quality, twin-bonded tubing with strict QA/QC not only on its materials but also on its size tolerances, to ensure they are leak proof and afford strong structural connections. QED's standard polyethylene (PE) and Teflon-lined PE tubing is rated to operational pressures of 300 psi (600-foot pump depths) as well as for supporting most pump systems to depths of 300' without the need for a support cable.

QED's technical field reps have perfected an installation methodology for measuring and coiling tubing and support cables on separate spools; this allows the technician to put a rod through the middle of the spool for support when lowering the cable down well. Tubing and cable come off of the spools in reverse, taking the coil memory out and preventing the entire pump system from spinning and wrapping up everything down well.

### **What Makes QED the Leader in Low-flow Deep-well Sampling?**

QED is a consulting manufacturer, making us completely different from a mail order company and unique in the industry. QED's technical experts pride themselves in knowing most every sampling application's equipment requirements better than the consultant or the end-user.



*Integrated MicroPurge<sup>®</sup> portable surface controls deployed at a wellhead in California. Note the 20-gallon drum for generated purge water from multiple wells.*

QED collects all the well data, including water chemistry, for a given site in advance of finalizing a quote or filling an order. We measure, precut, and preassemble each dedicated deep-well system in a clean room facility to the specifics of not just the site, but for each individual well – it's a huge savings in cost of materials as well as in the installation time and labor for the customer. QED understands the pros and cons of different approaches, materials, and operational methodology. We propose our recommendations for the application along with any alternatives and their associated costs. QED teams with the engineers and the end-user to deliver the best engineered value, not just the lowest cost. The system also includes our field-proven, value-added engineering expertise that starts with the initial inquiry and is available for the life of the project.

### **The Benefits of QED's Low-flow Deep-well Sampling System**

- With a QED dedicated low-flow system, the pump is installed once and the well is sampled whenever necessary; this makes sample collection easier and more accurate, and has cut labor costs at some sampling sites by 80%.
- QED offers a complete, integrated, engineered system for sample collection, as well as expert technical and field guidance before, during, and after the sale.
- QED was first in the industry with a standard 10-year sampling pump warranty. All of QED's bladder pumps come with this "no-loopholes" protection that covers the entire pump, including the bladder.