The Italian job

Claudio Guareschi describes how a Massenza rig was used to drill a well for mineral water on the Venetian plain

Main photo: Massenza M.I.45 rig

Idrogeo Snc Italy has completed a drilling operation to create a well that can guarantee long-term high quality and performance in the production of mineral water for San Benedetto, one of the world's major mineral water brands.

To ensure the level of quality required by San Benedetto, it was necessary to reach the fifth aquifer, found between 285m and 305m below ground level.

The casing was TIG-welded in a controlled atmosphere

Considering the complexity of the operation, the diameters of the hole and the weight of the rods, the drilling rig chosen for the job was the Italian-made Massenza M.I.45, equipped for a reverse-circulation operation.

This technique enables drilling in soft formations such as clay and sand, with big diameters and a high feed rate. The high speed of cuttings returning up the inside of the rods (3m/s) allows a precise reading of the different formations.

The scheduled programme for the creation of the well included five phases. The first phase involved the creation of a wide opening (guide tube) of 1m (40.5in) up to 23m deep. This was done with a casing oscillator, and by digging inside the casing with a bucket and telescopic rods.

Reverse-circulation drilling

Once the casing was placed, the second phase began, which involved reverse-circulation drilling. The objective was to reach a depth of 282m at 900mm (36in) diameter. This was achieved with the use of a composite rock bit with a 500mm (20in) top and a 900mm (36in) spreader, combined with heavy rods of 400mm (16in) diameter and double-walled drilling rods of 220mm ($8^{5}/_{8}$in) with an internal tube of 150mm (6in).

At 145m depth, corresponding to the third aquifer, a well spring test was carried out to analyse the chemical, physical and correspondent piezometry of the spring.

At 282m depth, all of the rods were removed and a steel 630mm ($24^{7}/_{16}$in) welded pipe was inserted into the hole. This conduit featured a reinforced shoe, which was fed by gravity into the bottom clay.

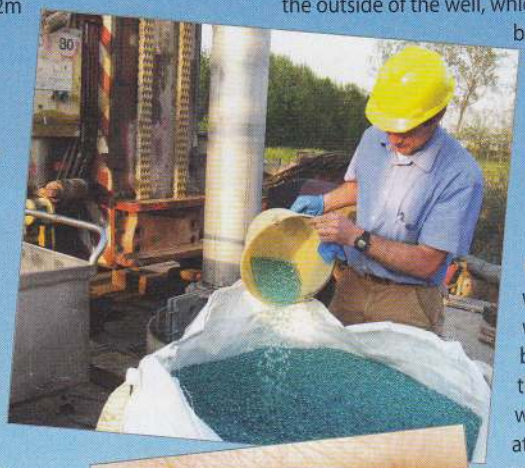
At the end of this operation, the annulus between the 600mm (24in) tube and the drilled hole of 900mm (36in) was filled with grout from the bottom up to the surface in order to protect the well from impure water filtrations, and other minor and more superficial springs.

The third phase began after having reconditioned the drilling mud, and checking its density was not lower than 1.035 kg/dm^3, in order to keep the piezometry of the fifth aquifer under pressure.

Drilling began with the composite 580mm (23in) rock bit, down to 306m. The final probe used was made out of 'Ra'-certified, internally polished stainless steel.

This casing had been TIG-welded in a fully controlled atmosphere. This complex welding procedure, combined with the internal polishing of the casing, was required to avoid the formation of biofilm bacteria on the surface of the tubes.

Having reached the final depth with the 350mm (14in) casing, phase four involved the installation of a 9m Johnson Screen filter, with a 12m blind casing attached to the top. This casing/filter had also been polished.



The filter was closed at the bottom. It was not equipped with a lower bag in order to avoid the formation of anoxic habitats, which could eventually modify the chemical and physical characteristics of the spring.

Once the filter reached the desired position and depth, drainage began, using 10mm-diameter glass spheres. These spheres were placed in position by gravity after having been sanitised with hydrogen peroxide, and after the desired heights had been checked with a dedicated sounding probe.

The stainless steel casing was then raised in order to uncover the Johnson filter so that water could finally flow in. The 600mm (24in) hole was then isolated from the 350mm (14in) casing with 2m of sodium compactonite, followed by grouting up to surface level.

Alternative technique

An alternative technique was used for phase five: the removal of waste materials. As standard drilling-rod piston movement might have damaged the polish of the casing, a Hydropuls procedure was used.

This involved using the sudden deployment of high-pressure gas towards the outside of the well, which produced a backwash of the fines located inside the well.

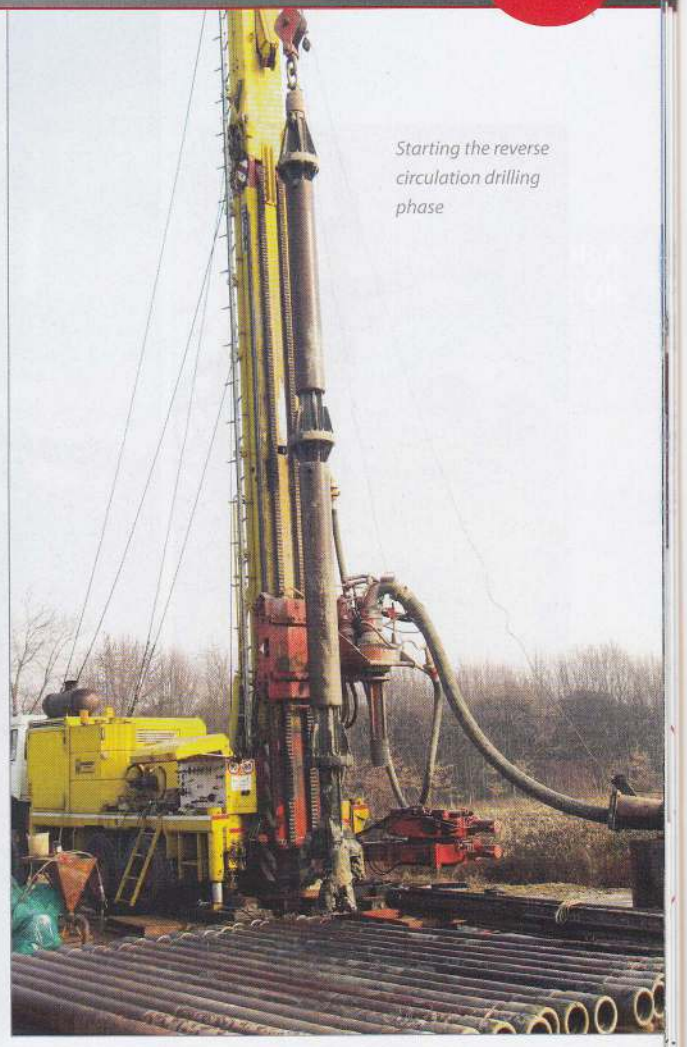
This final waste material was removed to the surface by the natural water flow, which at the beginning of the operation was measured at 25L/s. On completion of the job, the spontaneous flow was recorded at 60L/s. The step-down test was obtained with a lifting system made of a submerged electro-pump. A maximum flow of 103L/s was recorded at -6m.

Finally, a waterproof camera was used to inspect the result of the well construction and a final report was delivered to the client.

The project was completed in two days.

San Benedetto is now using the well at full power, with no problems reported.

Claudio Guareschi is the owner and operation manager at Idrogeo Snc Italy



Starting the reverse circulation drilling phase

36in reverse circulation hole opener with 17½in pilot bit