How to get to the bottom of borehole problems

Borehole maintenance specialist Geoquip Water Solutions outlines a number of investigation and treatment options for borehole remediation when water yield starts to fall

When the yield from a borehole starts to decline and/or the quality of the water loses its sparkle, underground investigation work will be needed. Typical problems may include a build-up of iron-related bacteria in the pipes, a break in the lining of the borehole wall, or a blockage within the pump itself.

Faced with such situations, borehole maintenance specialist Geoquip Water Solutions says there are a number of investigation and treatment options.

TESTING

The first, if time allows, is to undertake a simple biological activity reaction test (BART) to determine if bacteria are present in the borehole.

The tests can be carried out on-site and involve taking a water sample which, over an eight-day period, will develop a series of indicators within the test vial to show the type of bacteria present. Potentially this could be iron-related bacteria, sulphate-reducing bacteria or slime-forming bacteria.

Once this is established, correct treatment solutions can be applied quickly and effectively to flush out the bacteria and prevent further damage to water quality or corrosion of equipment in water pipelines and wells.

Treatments such as Geoquip's range of BoreSaver borehole cleaning and well rehabilitation solutions can then be used to target the specific type of bacteria, with one treatment usually enough to remove the deposits that have built up.

Options include BoreSaver Ultra C, which is capable of completely removing iron and manganese oxide deposits in as little as 24 hours, or the Ultra C PRO for more severe cases of iron oxide, manganese oxide and iron bacteria contamination.

A MultiKleen general all-purpose cleaning treatment can also be used when a wide range of residues are present, or if the exact composition is unknown. This completely removes deposits and slime from boreholes, wells, pumps and equipment.

Further testing can then be carried out – both after the treatment and ideally at six-monthly intervals – to ensure the problem has been eradicated.

A BART vial (centre) once it has been removed from the outer dispenser. A water sample (right) is ready to be poured into the test vial

SURVEY

If, on the other hand, no bacteria are found or time is more pressing, a downhole camera survey will be needed. Geoquip's Mike Deed recommends the Laval R-CAM 1000 XLT borehole camera which, as well as being extremely portable and suitable for use in the field, has two cameras, enabling the operator to see both a down view and a side view, including the ability to pan 360 degrees around the borehole.

Typically, it can identify trouble spots where, for example, the borehole casing has been damaged, allowing debris to fall onto the rising main, or identify if other materials are causing a blockage.

Darren Hughes, from D Hughes Well Drillers, says: "There is no point in just looking downwards, when you spot something you need to look at it, get a side view and pan around the borehole 360 degrees, and that's what this camera enables you to do.

Darren Hughes, from D Hughes Well Drillers checking the images produced by the Laval R-CAM 1000 XLT borehole camera to identify that a borehole was collapsing

"For example, if an old borehole needs relining or replacing, we can see where the damage is and make the appropriate recommendations."

In addition, he says, the portability of the unit has enabled him and his team to take it to more challenging locations, including down embankments and into cellars.

Among the recent projects where the camera has been put to good use has been at a large country estate, sporting and events venue on the south coast, where Hughes was called in to investigate a borehole problem and, thanks to the camera, was able to identify that the borehole was collapsing.

"Although the borehole was still cased to 10m, the hole ►

"The Borestorer uses high-pressure jetting technology inside the borehole"

further down was collapsing in, allowing chalk to fall on the rising main," he says. "The camera enabled us to see exactly where work was needed and we were able to re-line the casing to solve the problem."

CLEANING AND JETTING

Sometimes projects will be much more complex and recently, Geoquip worked with borehole maintenance specialist Drilcorp, which had been called in by a large water utility company after problems with three of its boreholes which supplied water to two large areas of population.

Mike Bushby, contracts manager within Drilcorp's Borehole Engineering Services division, explains: "These boreholes were part of a key water supply for two large areas of population and, understandably, the water company was reluctant to take them out of action for any length of time.

"Two recently drilled boreholes were supporting the water demand for the local area while the works were undertaken. However, it was important to complete the works before any increase in supply was needed."

Work began at the site in October 2019, with the first step being to remove the 8in riser pipe with flanged connections out of each borehole, a lengthy process involving a mechanical overhead gantry crane and grinding old, rusted bolts.

An example of typical iron bacteria residues on a pipe prior to treatment
Photo: Drilcorp

A camera inspection identified the condition of the three wells and what depths required the most intense jetting from Drilcorp's new Borestorer jetting machine.

A partial collapse of part of one borehole wall meant large pieces of iron, broken stones and pebbles had also been deposited, and the team was faced with a significant build-up of sediment and sludge. The third borehole had high suspended solids and turbidity requiring intensive airlifting.

The Drilcorp team first performed an airlift operation in each borehole and followed this up by bringing in the Borestorer, as Bushby explains: "The Borestorer uses high-pressure jetting technology inside the borehole, injecting water on a spinning wheel to quickly and efficiently remove any material encrusted onto the casing. This technology not only cleans the casing, but penetrates the formation opening fractures and pores previously blocked to improve well efficiency.

"The jetting was carried out over an eight-hour period per borehole, after which we performed another airlift to remove remaining debris, gathering it into tanks ready for disposal and safely pumping the wastewater into a nearby stream."

TREATMENT

With the physical cleaning completed, the next stage was an application of Geoquip's BoreSaver Ultra C Pro, which had already been specified as the best treatment solution.

Geoquip's Deed says: "A professional mechanical cleaning practice, as performed here by Drilcorp, to remove much of the loose debris and sediment from the borehole as possible is an essential part of a good, cost-effective treatment.

"This can, of course, impact on the amount of chemical required – getting the right dosage and using the correct methodology is very important in being able to achieve the best lasting results."

Additional maintenance and repair work was carried out by Drilcorp's engineers, before EGS, geophysical company, moved in to identify the well cavity properties, such as the cement bond and formation configuration.

Following cleaning, Drilcorp undertook a series of tests on each well. These tests consisted of clearance pumping with surging; to remove residual sediment and lower turbidity, step rate testing; to identify the well efficiency and result of the cleaning, and finally a constant rate test; to observe the reaction of the aquifer to pumping. For this testing Geoquip supplied an energy-efficient 150kW Franklin Electric E-Tech borehole pump which was run with an inverter with abstraction rates up to 80L/s.

The new hydraulic and water quality potential was calculated by the client and the data from the testing was sent to the client's hydrogeologist, who informed Drilcorp that the cleaning had improved the performance of all three boreholes.

A stainless steel ZSM rising main supplied by Drilcorp replacing the old flanged rising main in the three boreholes. Each of the headplates were refurbished by the sub-contractor George Green, the final element of the works was to install the above equipment into each borehole.

The project was an overall success with Bushby noting: "By using both the Borerestorer and BoreSaver cleaning processes, we were able to provide a good all-round clean and the combination of these processes, together with the partnership between our two companies, worked really well."

Deed concludes: "We were pleased that we were able to work in partnership with Drilcorp to overcome the contamination problems and ensure these boreholes were once again ready to supply both the quality and quantity of water required by the utility company to serve its customers."