Note on Testpumping Procedures

Testpumping is performed to determine the sustainable yield (Q) of a borehole and the depth at which the pump needs to be installed (PID). An advice on the pump (handpump or a certain type of motorised pump) to be installed can be given based on interpretation of the data, leading to an advised yield and an estimated dynamic water level (DWL) The textbook procedure for testpumping is described below.

In order to get a first estimate of the yield of a borehole, a step test is performed. Water is pumped from the borehole in 4 steps of increasing rate for equal length of time, preferably 1 ½ hour. The pump rates are ideally based on the driller's yield and a step is performed at 0.3, 0.6, 0.9 and 1.2 times this figure. If the driller's yield is unknown, as is often the case for old boreholes, the knowledge and judgement of the testpumping technician becomes all important to determine the rates at which to perform the test.

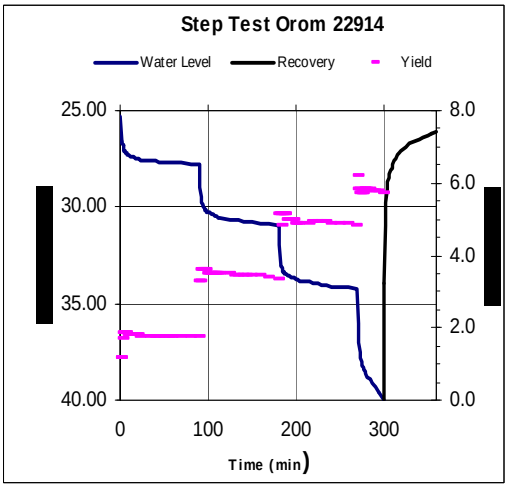

Figure 1. Drawdown versus time

The drawdown is measured at fixed intervals. The water level stabilises within the duration of the 1st step and the rate is increased, as is shown in the example in Figure 1. This procedure should be repeated until the water level no longer stabilises or the drawdown is such that the water level is reaching the pump intake. See step 4 in Fig.1. Sometimes more than 4 steps are required, sometimes less steps can be performed. The position of the screens and the depth of he pump intake (which should never fall dry) determine to which level the water can be pumped. The difference between this level and the static water level (SWL) is the available drawdown.

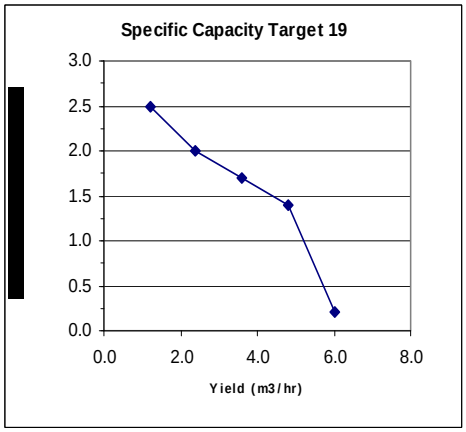

Figure 2. Specific Capacity versus Yield

The specific capacity of a borehole is the yield per meter of drawdown (m^3/hr/m). This specific capacity decreases with increasing yield. From the steptest several values for the drawdown after a fixed period of time at certain yields (the steptest rates) are known. When plotted as specific capacity versus yield, the curve will show a distinct kink at the rate above which the aquifer is being depleted, indicating the optimum, highest possible yield. The CR test should then be performed at this rate (5m3/hr in the example in Figure 2) to certify the sustainability of this pump rate

This rate is lower than the rate at which the test needed to be stopped, and equal to or a bit higher than the highest rate at which the water level stabilised, without running the risk of the water level dropping to the level of the pump intake or reaching the screened sections of the permanent casing..

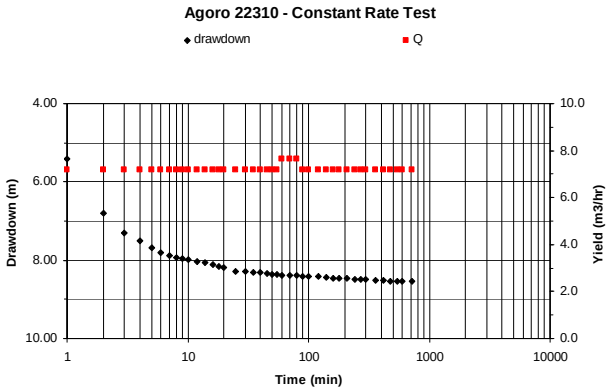

Figure 3. Constant Rate Test

The duration of the CR test is dependent on the yield and the daily use of the borehole. A 3 to 6 hour test will suffice for a handpump borehole. A motorised production borehole which will be used in the daytime only, for instance because it is powered by solar energy, should preferably be tested for 24 hrs, or 12 hrs at the least (see figure 3). A production borehole for a town water supply, which might eventually run constantly, should be tested for 72 hours.

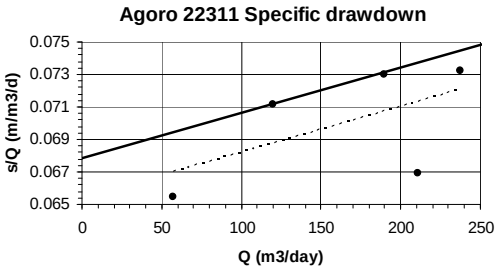

Figure 4. Specific drawdown graph

From the CR test another value for the drawdown at a certain pump rate is obtained. Combined with the steptest data, the specific drawdown can be estimated, showing the expected drawdown in m for any m^3/hr of pumping rate. See figure 4.

The available drawdown needs to be calculated. The design of the borehole plays an important role in this procedure: the water level should not drop to the level of the screens to prevent water cascading into the borehole. Also a screen should not fall dry to prevent bacterial growth. A safety margin of 2 m is used. This defines the maximum drawdown when the pump is installed below the screens. If the pump is above the screens, the pump intake level defines the maximum drawdown, considering a safety margin of 3 m. The static water level combined with the maximum drawdown gives the available drawdown.

From the available drawdown and the specific drawdown graph, the maximum sustainable yield corresponding to the available drawdown can be calculated. The recommended yield is a percentage of this figure, based the experience and knowledge of the hydrogeologist, taking into account the reliability of the data and limited validity of assumptions made in the course of mathematical calculations. The recommended yield, via the specific drawdown, leads to an expected DWL. This DWL defines the head against which the pump has to pump the water to the surface. If the design of the distribution system is known, the height above ground level at the borehole to which the water eventually has to be pumped is known. The total head can be calculated by adding this height and the DWL and accounting for friction losses in the pipes. The total head and the advised pump rate can be combined to determine the advised pump type to be

installed. Also the pump installation depth (PID) shall be advised, depending on the design of the borehole. Note that the head does not depend on the PID, but on the DWL.

Although there are quite a number of testpumping units active in Uganda, the knowledge on how to perform a proper test and especially on how to interpret the results is not so common, even among drillers. This leads Clients to design contracts stipulating in advance exactly the time each test should take, without taking the hydrogeological characteristics and behaviour of the borehole into account. Since testpumping is commonly paid by the hour, there is a need to put a strong limit on the time to be spent for each test. This will lead to inadequate tests and incorrect advice on yield, DWL and the pump to be installed. If the pump is too small, the beneficiaries are not served well, while an unnecessarily big pump runs the risk of breaking down by falling dry and is cost inefficient. It would be better to have a professional and integer Consultant perform the tests, which sometimes can be longer and sometimes shorter than the predefined average time to be spent. Hiring an professional Consultant will also ensure that reporting is up to standards, which is seldom the case. There are “reports” with only a sheet with measured data on time and water level, no interpretation at all! Crucial factors of specific capacity and available drawdown are not taken into account.

WE-Consult offers testpumping services at competitive rates. The field team has a broad experience and the knowledge to design the proper test in the field for each borehole. They can adept to changing circumstances and receive logistical back-up from the main office in Kampala. Attached you will find a standard WE-Consult reporting format for a full testpumping procedure.

If you need any more information on testpumping procedures and equipment or the company’s experience, please do not hesitate to contact us or visit our website www.we-consult.info.

Kind Regards,

Ron Sloots
Director