Testing of boreholes

Certainly one of the most important factors concerning one’s borehole is its management. How much water can I pump over the long term without drastically affecting the yield and making sure that the borehole is not pumped dry? It should be stated clearly that a borehole test where only the yield and no water levels has been measured does not mean anything in terms of borehole yield (strength), and is at best a test of how the pump equipment performs.

Important criteria

There are a number of aspects that needs to be taken into consideration when testing a borehole, there are two important rules that needs to be kept in mind when determining the sustainable yield i.e.: The total abstraction from a borehole should be less than the natural groundwater recharge, and secondly, a borehole should be pumped in such a manner that the water level never reaches the position of the main water strike (normally associated with a fracture). Should this happen the yield will inevitably be affected and the borehole would eventually dry up.
Specific information is required to properly test a borehole, these can be listed as follows: what is the rest water level before the start of the test, how does the water level change over time once pumping has started, how long does it take for the water level to recover after the pump has been stopped to recover to the original level – or how far does the water level recover after the same amount of time allowed as for pumping – leaving a residual drawdown.

**Why test?**

Test pumping of boreholes is normally carried out to meet two main objectives:

1. To establish borehole potential. To estimate the sustainable yield and hydraulic performance of individual boreholes for water supplies.

2. To establish aquifer potential. To assess the hydraulic characteristics of the aquifer to determine groundwater resources.

**How does G.M. Todd Irrigation test?**

Test pumping consists of pumping a borehole at a specified rate and recording the water level (and therefore the drawdown) in the pumping well as well as in nearby observation boreholes at specific time intervals. When these measurements are substituted in appropriate flow equations, certain hydraulic parameters can be calculated. These parameters, together with qualitative assessment of discharge-drawdown characteristics, are then used for the assessment of a recommended yield of the boreholes and or aquifers.

There are three primary types of borehole yield test’s, step test, constant rate test and a recovery test. Prior to any test, a calibration test exercise is carried out to adjust and calibrate the pumping equipment at various discharges.

**Step test**
During this test the pump rate is increased in steps at regular intervals. For example a borehole may be pumped at rate of 1000l/hr for a period of 1 hour and increased thereafter to a rate of say 2000l/hr for the next hour and so on for several more steps. This type of test is particularly useful to determine the effectiveness of the borehole, but not too useful in determining the long term sustainable yield of a borehole. In this regard the constant rate test is more useful.

**Constant Rate Test**

In the Constant Rate Test (CRT), the borehole is pumped at a constant discharge rate over a period ranging from 8 to 48 hours (or longer) – the length of the test is normally proportional to the expected yield and importance of the borehole. The discharge is kept constant for the duration of the test, and water levels are recorded in the pumping borehole as well as observation boreholes (if any). The time-drawdown data obtained from the CRT is then analyzed for quantitative (estimation of transmissivity, storability and hydraulic parameters) and qualitative analysis of borehole and aquifer response to pumping. The analysis provides useful input to assess the sustainable yield of individual boreholes and the potential of aquifers. Hydro geologists are trained to utilize different mathematical equations to estimate a sustainable yield.

**Recovery Test**

In this test, recovering water levels are measured in the pumping borehole immediately after the CRT, when the pump is switched off. This recovery test is very useful in qualitatively assessing the pumping effect and possible dewatering of aquifers that may result due to the limited extent of an aquifer.

Furthermore the recovery test will indicate the level to which the aquifer is actually dewatered by measuring the residual drawdown after the borehole was allowed to recover.