

LIMAX

Applied Science Developed in Australia by CSIRO, Flinders University and Kremford Pty Ltd.

Slug tests are the usual preferred option when testing aquifers. During a test, a slug is immersed into the driving well. The water displaced by its volume produces a corresponding change in pressure and this change is recorded by a driving well sensor. In a screened well, as the pressure increases water is forced through the screen into the surrounding soil. How far and how quickly this pressure change travels through the soil is detected in nearby observation wells by similar sensors. Aquifer properties are estimated from a slug test by fitting mathematical models to the displacement data recorded by the sensors.

A slug test is relatively simple, requires minor equipment, and can be completed in a matter of hours, providing a relatively low-cost solution.

Historically, slug testing methodology consisted of plunging a handheld slug into the driving well and attempting to ascertain results from recording this single event. However, in most cases the results are only an indication of the aquifer parameters, and do not provide the accuracy required. This type of testing has a margin of error of twenty to forty percent, most of which is represented by the difficulty of adequately modelling such a transient event.

A relatively new development in aquifer testing involves the use of sine waves. This involves driving the slug immersion in the driving well so the slug movement and consequently the pressure changes mimic a continuous sine wave. The timed movement of the slug is converted to a series of long-term pressure waves that are recorded as pressure head fluctuations in all wells. These readings serve as inputs to aquifer test analysis software and this procedure is termed sinusoidal slug testing

Current research indicates that data from this approach provides more information and can be more extensively interpreted than previous test methods. The more complex the analysis becomes, to rely fully on the results, the more accurate and fine-tuned the testing equipment needs to be.

The Limax equipment consists of a software-controlled motor driven cable winch system capable of providing the smooth sine waves that drive the slug cycle with periods from minutes to hours. The test displacement data recorded by the Limax equipment consists of a CSV table recording the time at each

sample, the slug depth in the driving well, and the corresponding pressures in each monitored well. Additional data recorded for each test includes the GNSS recorded date, time and location along with the various sensor and well parameters.

The Limax system development identified the key technical challenges to producing a continuous sinusoidal slug movement. Essential to the development was the integrated design that seamlessly synchronized digital controls with mechanical components and implemented tailored control algorithms to manage motor timing and acceleration. The use of wireless communication for sensor reading and system control means the user has complete control over all aspects of the test, including the ability to view and analyse the current test data in real time.

For further information go to:
www.kremford.com.au

