



AN INTRODUCTION TO PUMPING TESTS

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As water system operations specialists, many of you have worked with water well contractors to coordinate pumping tests on your new or existing water supply production wells. There are different types of pumping tests conducted for various purposes and durations. I think it's important to understand these tests and their function. There are two general types of pumping tests: (1) step drawdown tests and (2) constant rate tests.

STEP DRAWDOWN TESTS

A step drawdown test involves pumping a water well at multiple flow rates. The pumping rate is kept constant for the

well in New York. This example has four different pumping steps. There are two chief reasons to perform a step drawdown test. One is to determine the optimum pumping rate for a long duration constant rate test. Based upon the results shown on Figure 1, a pumping rate of 600 gallons per minute (gpm) was chosen for a subsequent 72-hour constant rate pumping test. The other reason to conduct step drawdown tests is to measure pumping efficiency and the relative success of well rehabilitation and/or development efforts. Production well performance is commonly measured by calculating the specific capacity (Sc) of a well. Specific capacity equals the pumping rate (in gpm) divided by the water level drawdown (in feet). The performance of existing production wells

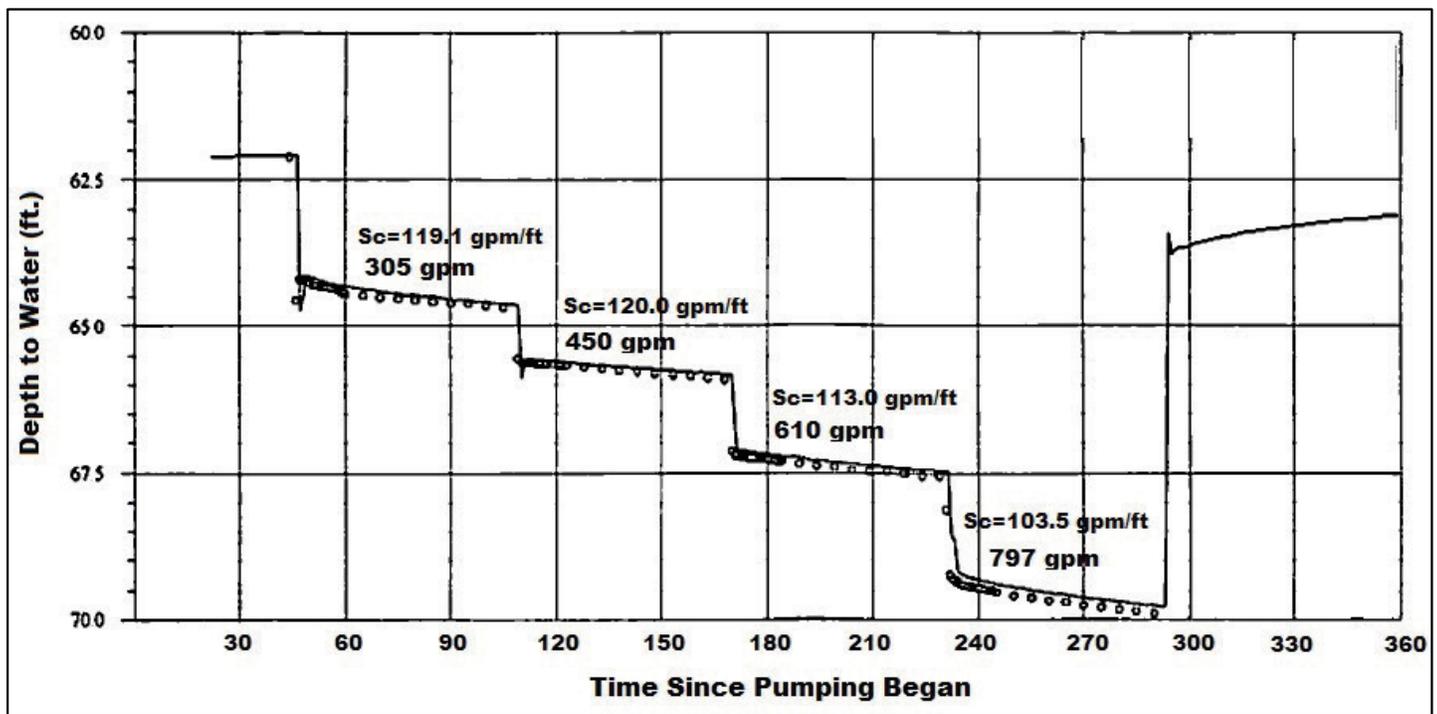


Figure 1

duration of each step, and then progressively increased. The length of each step typically varies from one to two hours. The observed drawdown or water level in the well is then plotted versus time. As a guide, step drawdown pumping rates often start at approximately 25 percent of the desired well yield, and advance at higher rates in approximately equal steps until the water level fails to stabilize during the step period.

Figure 1 is an example of such a plot for an actual production

well. The specific capacity should be assessed and the specific capacity calculated at regular intervals in order to determine if they should be rehabilitated or not.

CONSTANT RATE TESTS

As its name implies, constant rate tests involves testing a well at a constant pumping rate for an extended period of time. As spelled in Part 5, Subpart 5-1, Appendix 5D of NYSDOH regulations, the required length of time for constant rate tests ranges from 4 hours for transient, non-community systems to seventy-two >>>

hours for community water systems. Any water system (or other entity) with the capability to withdraw 100,000 gallons per day or more (with some exceptions) must obtain a water withdrawal permit from NYSDEC. Note that capability is the total maximum capacity of all sources, independent of how they are plumbed.

For any water withdrawal permit that involves new or additional groundwater sources or reassessment of previously permitted wells, 72-hour constant rate pumping test(s) are required. If multiple wells in close proximity to each other are involved, a 72-hour test must be performed on at least one well and tests on other nearby wells can be shortened to 24 hours if certain conditions are met. The proposed production well should be pumped during the test at a rate greater than or equal to the desired rate of withdrawal in the water supply application. The NYSDEC has a detailed pumping test protocol for water withdrawal permitting. So does the Susquehanna River Commission and the Delaware River Basin Commission if your system is within the jurisdiction of one of these entities.

There are several purposes of conducting a constant rate test. Such a test helps to determine the long-term safe yield of a well and allows the design of the permanent pump and its depth setting. Constant rate tests also evaluates the capability of the aquifer to

produce the desired quantity of water without impacting other groundwater supplies or surface water. Such tests also allow the calculation of so-called aquifer parameters. These are hydraulic properties of the aquifer that are used to predict the amount of drawdown in the well in the future, to determine the drawdown in the aquifer at various times and distances from the well, to calculate the amount of well interference from other pumping wells, to determine optimum well spacing in a well field, and to identify various source water protection zones.

Figure 2 is a time drawdown plot from an actual constant rate pumping test. In this example, the pumping well (Well 3) reached a period of apparent drawdown stabilization at the close of the test.

FINAL THOUGHTS

Pumping tests are a critical technique for water systems to assess well and aquifer performance, and to determine the relative impacts of long-term pumping. Lengthier tests must be done for new well approval or for the request of higher withdrawal rates. However, shorter-duration tests should also be conducted at regular intervals in order to judge well efficiency for existing wells.

If you have any questions about pumping tests, I would be glad to assist you! 💧💧