

ENCE 621/489G Homework 8

Due 12/8/2004

1. Type Curve and Pumping Test, Inverse Procedure Using Computers

Use the following data and the Theis's method to estimate the transmissivity and storativity of a confined aquifer. The pumping rate is $2943 \text{ m}^3/\text{day}$. The observations were taken at time = 2 min. You will need the spreadsheet Theis.xls that you may download from the class web site at <http://research.umbc.edu/~jgwo/Courses/IntroductionToSubsurfaceHydrology/>.

Table 1. Pumping test data.

Distance from pumping well, r (m)	Average drawdown, s (m)
15.25	0.9272
30.5	0.6588
45.75	0.49715
61	0.3904
91.5	0.244
122	0.15555
152.5	0.10065
183	0.0671
213.5	0.04575
244	0.0305

2. Type Curve and Pumping Test, Graphical Procedure

The following drawdown–time observations were obtained from a pumping test at a field site. The data were collected at a distance 60 m from the pumping well. The

pumping rate is $1.43 \times 10^3 m^3 / \text{day}$. Estimate the transmissivity and storativity of the aquifer. Note that the values listed in Table 2 are already plotted in one of the class handouts, with an accompanying type curve. Please use the handouts for your calculations here.

Table 2. Pumping test data.

time since pumping started (min)	drawdown, s (m)
1	0.2
1.5	0.27
2	0.3
2.5	0.34
3	0.37
4	0.41
5	0.45
6	0.48
8	0.53
10	0.57
12	0.6
14	0.63
18	0.67
24	0.72
30	0.76
40	0.81
50	0.85
60	0.9
80	0.93
100	0.96
120	1
150	1.04
180	1.07

210	1.1
240	1.12

3. There are two pumping wells located 50 m apart. Both wells tap into a local confined aquifer for water supply purposes. The transmissivity of the aquifer was estimated to be $125 \text{ m}^2/\text{day}$ and the storativity was estimated to be 1×10^{-2} . The original hydraulic head of the aquifer is 61 m above a common datum. One of the wells is pumping at a constant rate of $1500 \text{ m}^3/\text{day}$. In order to conform with local regulations, the maximum drawdown 10 m away from the two wells is set to be 10 m 24 hours after the pumping starts. Pumping at the two wells are always initiated simultaneously. Determine what is the maximum allowable pumping rate of the second well. Please use the EXCEL workbook Theis.xls for your calculation. Once you're done with the calculation, please plot the compounded equipotential surface.
4. After 24 hours of pumping a confined aquifer, the drawdown in an observation well at a distance of 97.5 m is 0.6 m and the drawdown in an observation well at a distance of 33.5 m is 1.1 m. The pumping rate is $5.43 \times 10^3 \text{ m}^3/\text{day}$.
- Determine the transmissivity and the storativity of the aquifer.
 - The diameter of the pumping well is 60 cm. Determine the theoretical drawdown at the pumping well using the Theis' solution.
 - The efficiency of the well is determined to be 60% after one day worth of pumping. Determine the well loss and the well loss constant using the following equation:

$$s_w = CQ^{1.98}$$

where C is the well loss constant and Q is the pumping rate.

- If the pumping rate is doubled, what is the well efficiency after one day of pumping?