CE 4363/5363 Groundwater Hydrology February 16, 2022

Homework Assignment 4

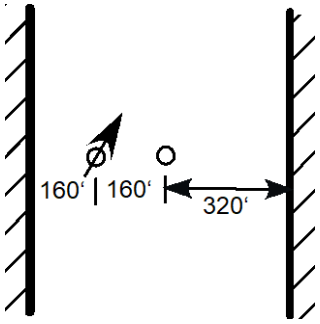
1. Problem 5.16, using Excel as shown in class and only the Cooper-Jacob analysis. Note that the sandstone layer is the confined aquifer.

2. The Theis and Cooper-Jacob equations can both be used to calculate drawdown for confined aquifer transient problems. A fully penetrating pumping well flows at 300 gpm in a confined aquifer with transmissivity of 11,500 gpd/ft and storage coefficient of 0.00043.
[a] Find the drawdown at an observation well 125 ft from the pumping well at 3 hr after pumping started using both equations.
[b] For this distance of 125 ft, at what time value in hr does u=0.01?

3. Use a spreadsheet, like in the previous homework, to show how variations in T and S affect transient drawdown curves in an ideal confined aquifer at r = 1, 5, 10, 15, 30, 60, 90, and 120 m when Q = 10 L/sec and t = 400 min. You may use either the Theis or Cooper-Jacob solutions, but make sure the u value is not too big.
[a] For $S=5x10^{-4}$, plot drawdown vs. r for $T=1.0x10^{-1}$, $1.0x10^{-2}$, and $1.0x10^{-3}$ m^2/sec on one graph.
[b] For $T=1.0x10^{-2}$ m^2/sec, plot drawdown vs. r for $S=5x10^{-3}$, $5x10^{-4}$, and $5x10^{-5}$ on one graph.

4. A single ideal pumping well, with radius of 1.0 ft and flow rate of 155 gpm, exists in an ideal confined aquifer. The aquifer has a saturated thickness of 82 ft. The pump continues running until equilibrium conditions are reached. The drawdown at the pumping well is 42 ft, and the drawdown at an observation well 138 ft away is 7.5 ft.
[a] Find the transmissivity in ft^2/d and hydraulic conductivity in ft/d.
[b] Find the radius of influence in ft.

5. An unconfined aquifer exists where a buried river channel cut into underlying impermeable bedrock. The figure below shows the orientation and pertinent dimensions. The flow rate at the pumping well is 250 gpm, and its radius of influence is 1000 ft. The hydraulic conductivity of the aquifer is 15 ft/d, and the initial saturated thickness is 120 ft. Find the drawdown at the observation well under equilibrium conditions.



6. A single pumping well, with a flow rate of 250 gpm, fully penetrates a confined aquifer. The aquifer has a saturated thickness of 110 ft, hydraulic conductivity of 20 ft/d, and storage coefficient of 0.00050. Due to outcropping of the aquifer, a no-flow zone exists 200 ft east of the pumping well and extends as a straight line to both north and south. An observation well is located 100 ft south and 120 ft east of the pumping well. Use a spreadsheet to find the drawdown at the observation well at time t=1, 5, 10, 20, 30, 40, 60, 80,

100, 120, 240, 480, 600, 720, 840, 960, 1200, and 1440 min after the well is turned on. Plot the drawdown vs. log time as in the Cooper-Jacob method. Can you see a change in slope? What would happen if the boundary was constant head? What simple change can you make in your spreadsheet to show that difference? Show both lines on the same graph.

7. Consider the figure below. Wells 1, 2, and 3 are pumping wells, and Obs 1 and 2 are just observation wells (no pumping at all). Provide a sketch to scale, drawn with a straightedge, that shows all the proper image wells necessary to represent the impacts of the two boundaries on the pumping and observation well drawdowns.