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HWRS 482

Ty Ferre

February 16, 2021

Assignment 5

**Head vs x**

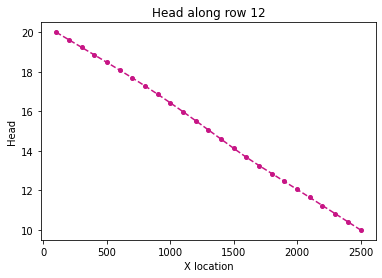


Figure 1: head in homogenous medium with no recharge or pumping

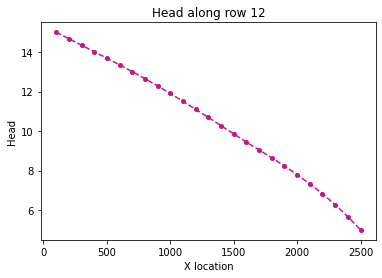


Figure 2: reduced head, no recharge or pumping

Describe the gradual drop in head as it crosses the confining layer at 10 meters.

As the head falls below the confining layer, transmissivity decreases with the head approaching 5 meters. As it decreases, there becomes greater resistance to flow and requires more energy to be expended in a greater loss in head. This means that the slope of the head distribution will be more negative at lower heads.

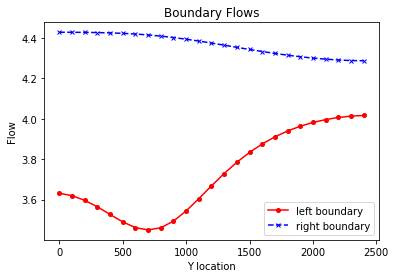


Figure 3: left and right flow of Head: 20-10

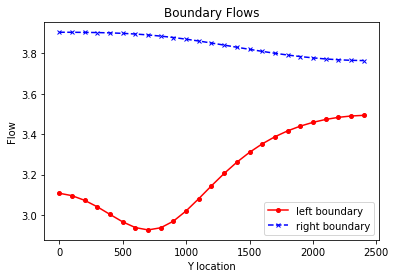


Figure 4: left and right flow of Head: 15-5

Describe the impact on flow when the head gradient crosses the confining layer.

Now that flow takes place with less transmissivity below the confining layer, more of the energy that drives flow is diverted towards overcoming the resistance produced by the head that falls below the confining layer.

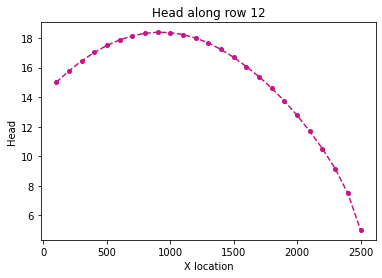


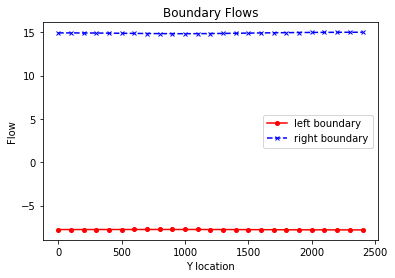
Figure 5: with recharge10

Figure 6: flow with recharge

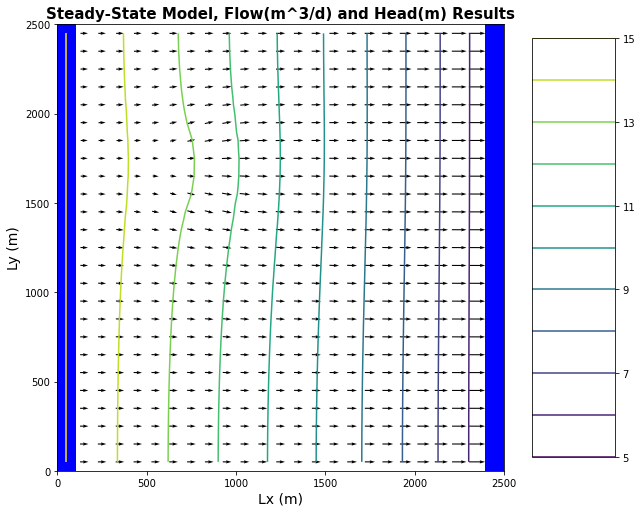


Figure 7: flow vectors with recharge, with contamination zone

As recharge enters the system, the water table will rise and across X and Y. It doesn’t look like they add as much to the edge as it does the center and this might have something to do with the bump at the end of Figure 2. With recharge, we also see negative flow from the left, likely because of the inverted slope of head on the left side. Flow is 3D and it is depicted in the 2D plan view as Figure 6 shows flow along y at two distinct x coordinates.

Annual Excess Irrigation: (1e-4)m/day \* (4\*100)^2m^2 = 16m^3/day

16/(2500^2) = 2.56e-6 meters

Total Annual Irrigation:

Cotton Water Demand: 7.8 megaliters/hectare

Area: 400 meters \* 400meters = 160,000 m^2

160,000m2 \* 1hectare/10000m^2 \* 7.8 megaliters/hectare = 124.8 megaliters

Area at Risk: by looking at the head distribution with recharge from the farm, it looks like contamination will be contained to down gradient of the farm as seen in Figure 7.

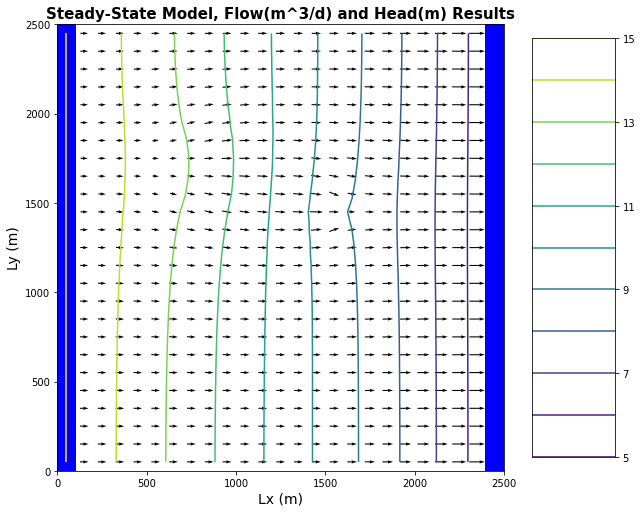


Figure 8: flow direction with recharge and pumping, contamination in orange and capture zone in blue

The well bends the equipotential contours down gradient of the farm slightly, widening the area of the contamination zone and even redirecting more contamination into the capture zone.