

HW10 “Layered” Figures

1. Compare the impact of pumping on the single layer model vs the multi-layer model. What physical explanation do you have for the differences?

Tables 1 (1-Layer) and 2 (3-Layer): Total Volume (m^3) Calculations

1-Layer Flux		3-Layer Flux	
IN:		IN:	
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STORAGE =	0.0000	STORAGE =	0.0000
CONSTANT HEAD =	841.3206	CONSTANT HEAD =	688.2673
WELLS =	0.0000	WELLS =	0.0000
RECHARGE =	1200.0000	RECHARGE =	1200.0000
TOTAL IN =	2041.3206	TOTAL IN =	1888.2673
OUT:		OUT:	
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STORAGE =	0.0000	STORAGE =	0.0000
CONSTANT HEAD =	1541.3204	CONSTANT HEAD =	1388.2673
WELLS =	500.0000	WELLS =	500.0000
RECHARGE =	0.0000	RECHARGE =	0.0000
TOTAL OUT =	2041.3204	TOTAL OUT =	1888.2673

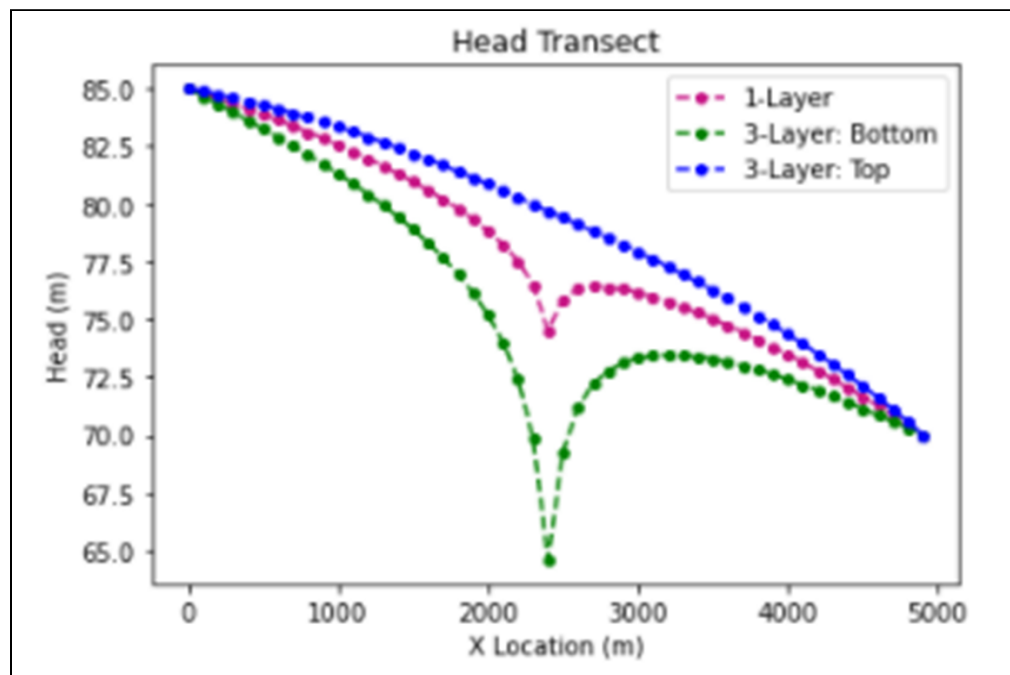


Figure 1: Transects of head along the well row ($y=2500$) for the 1-layer scenario, the bottom layer of the 3-layer scenario, and the top layer of the 3-layer scenario.

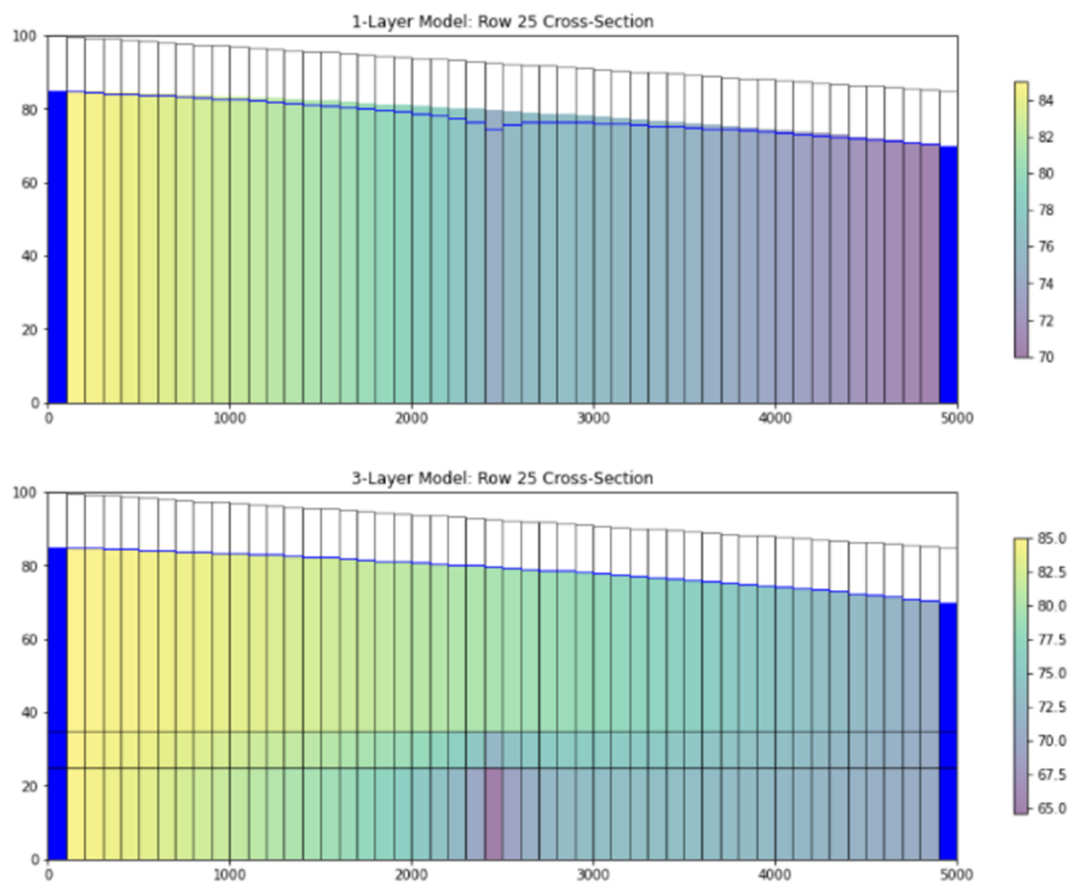


Figure 2: Cross-sections of the 1-layer and 3-layer scenarios. The 3-layer scenario has the well screen in the bottom layer. Head (m) is represented by color.

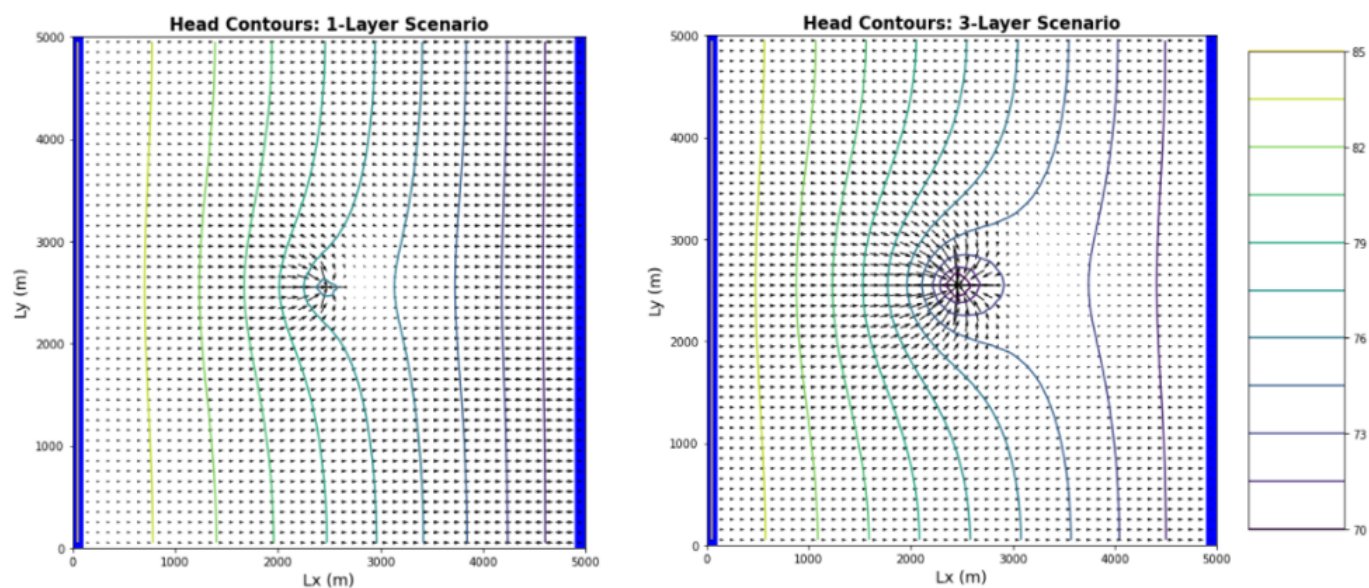


Figure 3: Map view of head contours and flow lines for 1-layer and 3-layer scenarios.

2. Repeat the three layer simulations putting the well in each layer (i.e. once in the bottom once in the middle and once in the top) provide plots and discussions comparing and contrasting your simulations. Provide at least one plot where you have all of your runs in the same figure.

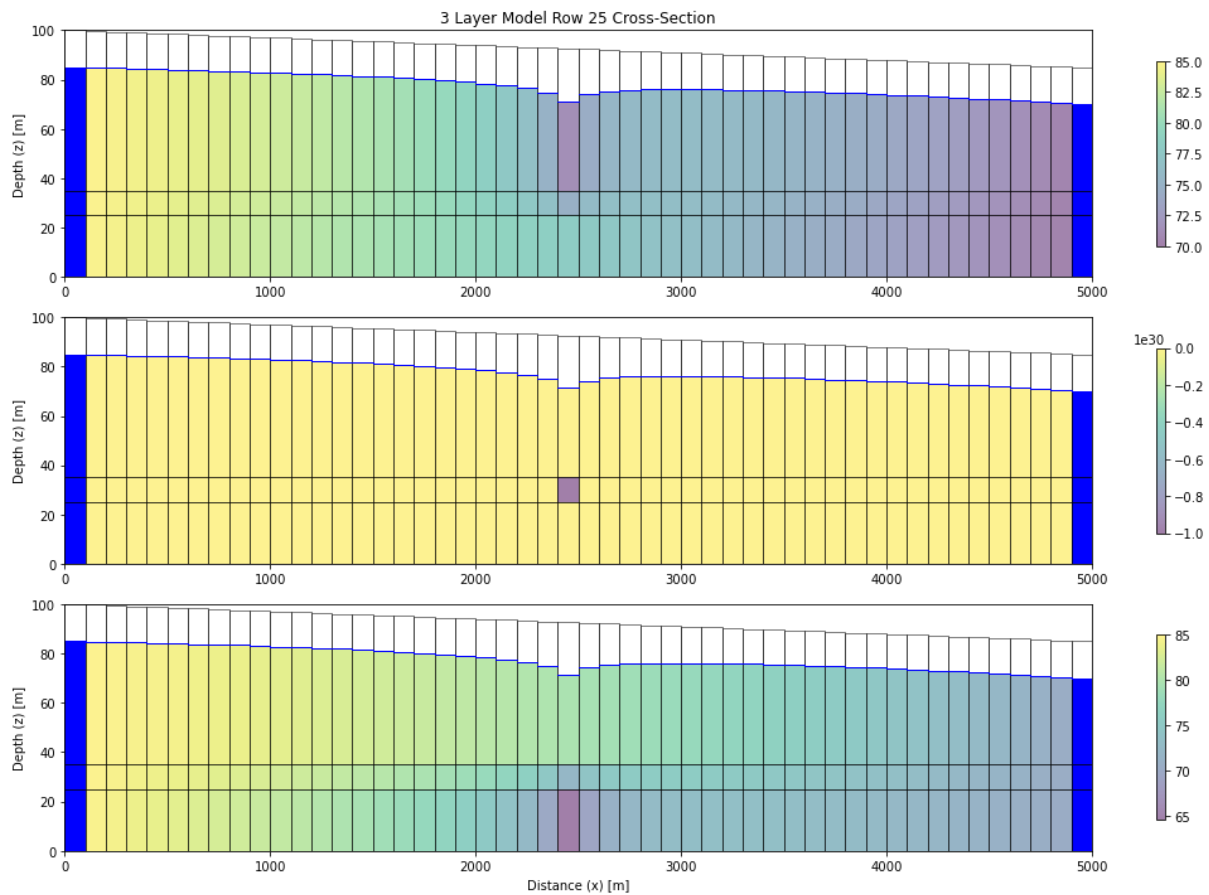


Figure 4: Comparison cross section of head values in each cell along the flow domain (x direction). Pumping well is located at the center of the domain (2500, 2500), and is pumping at 500 m³/day. The second graph may have issues.

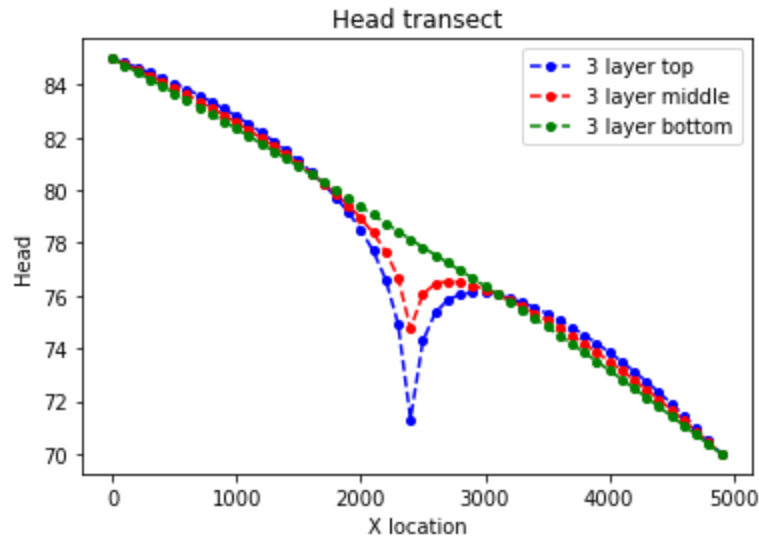


Figure 5: Head values along a transect taken through the pumping well when the well is located in the top layer of the model. The blue, red, and green lines indicate the head profiles for each of the three layers as depth increases downwards from the surface.

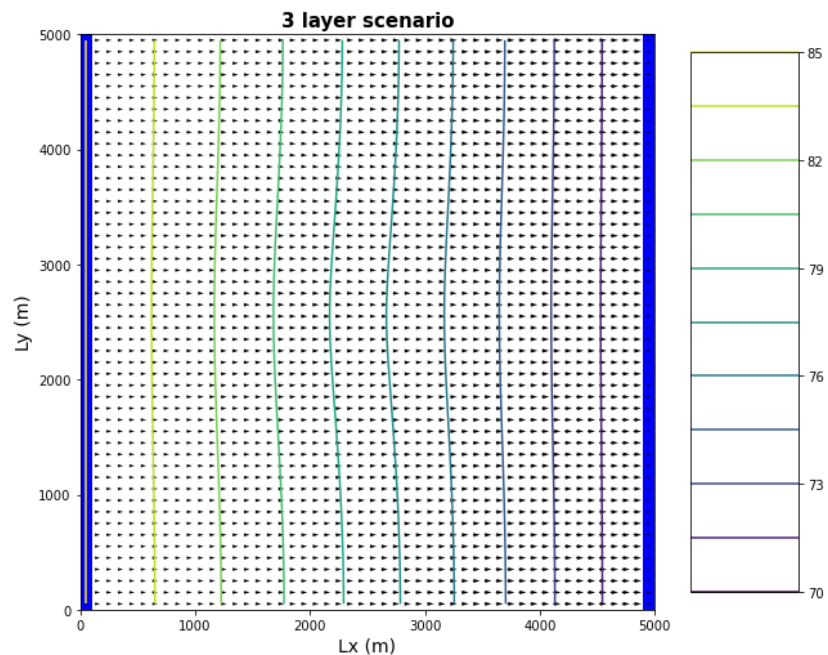


Figure 6: Equipotential and flow lines for the top layer of the three layer flow domain.

3. Change the properties of your three layer model so that it matches the 1 layer model (but still has 3 layers) put the pump in the bottom layer and compare and contrast with your one layer solution. How does your answer to this challenge compare with your answer to the first?

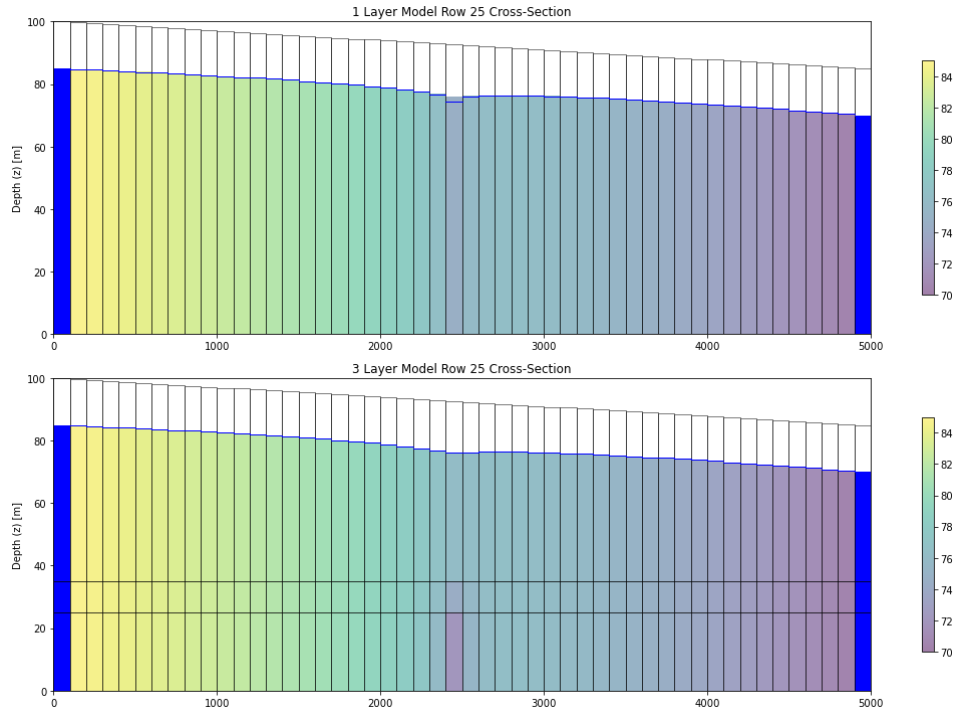


Figure 7: Cross sections of the flow domain along row 25 of both the one layer and three layer models. Pumping well is located in the middle of each domain (2500, 2500), and is in the bottom layer of the 3 layer system on the lower graph.

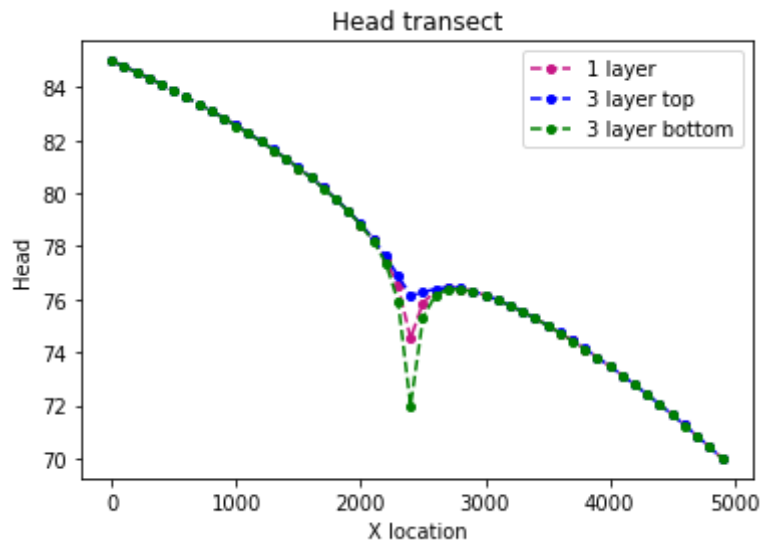


Figure 8: Head transect through the pumping well. Behavior of one layer system shown by pink line, blue and green lines indicate behavior of head profiles in top and bottom layers of 3 layer flow domain, once adjusted to match one layer system.

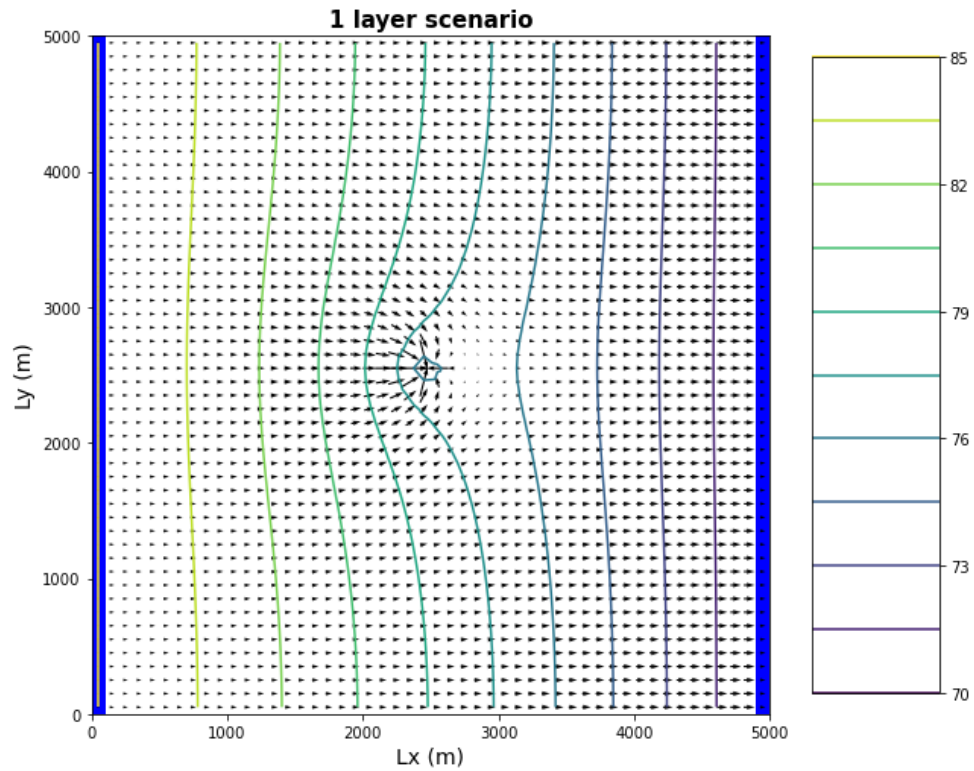


Figure 9: Equipotential and flow line interaction with pumping well in the one layer flow domain.

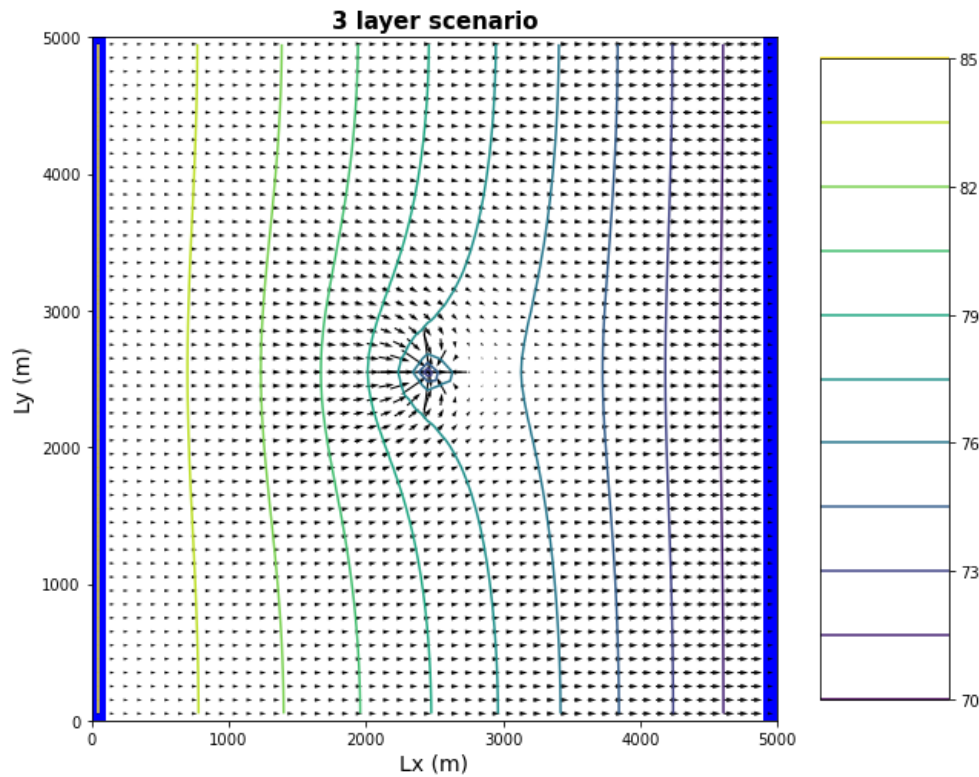


Figure 10: Equipotential and flow line behavior in top layer of the three layer flow domain.

4. Modify the topography of your domain so that it is no longer sloping left to right (you can make it a valley or have it sloping the other way, whatever you want). Re-run your 1 and 3 layer solutions and explain any differences you do or don't see.

A. Slope to the Left (opposite of what we saw last time)

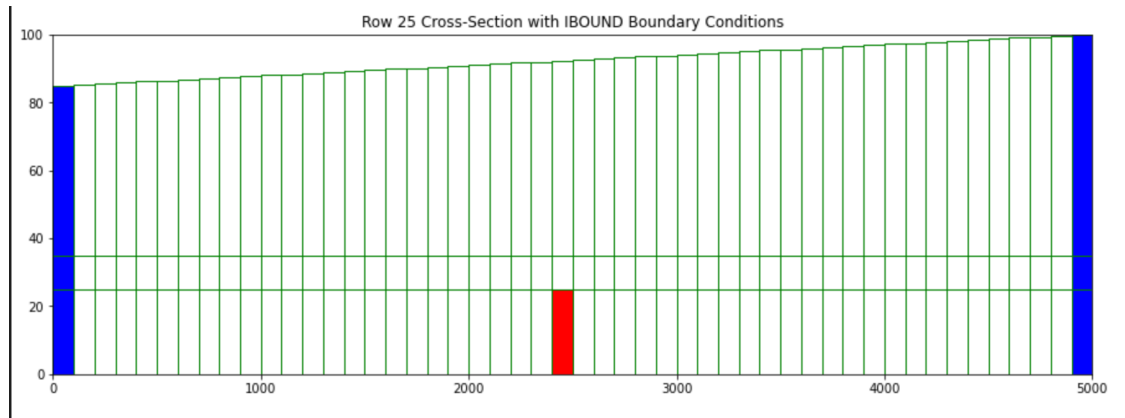


Figure 11: Topography domain with slope to the left instead of the right for the three layer scenario. The well is shown in bright red.

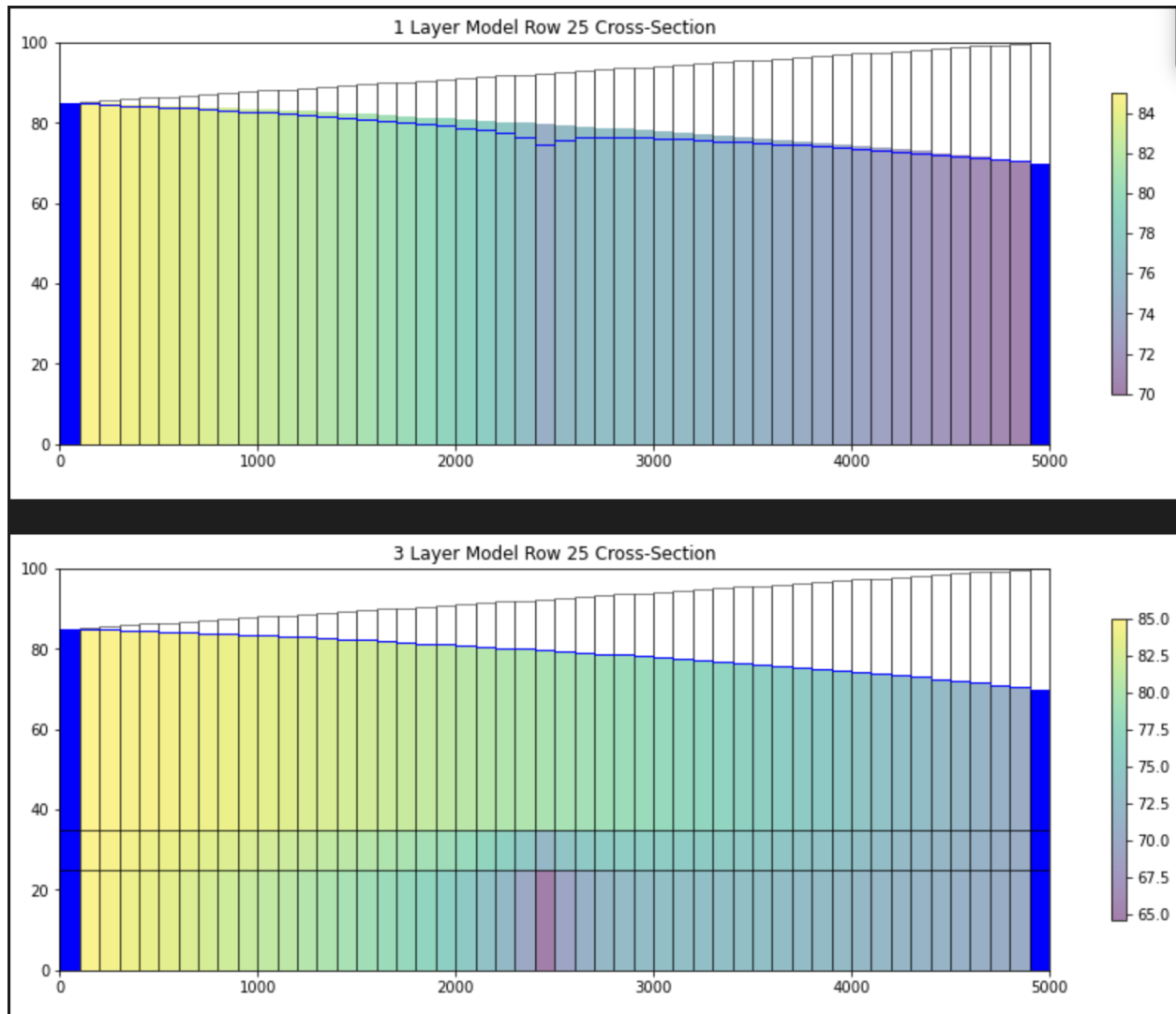


Figure 12: Head profiles for cross section of the domain with slant to the left. Note we have constant head boundaries on each side, therefore the water table slants the opposite direction.

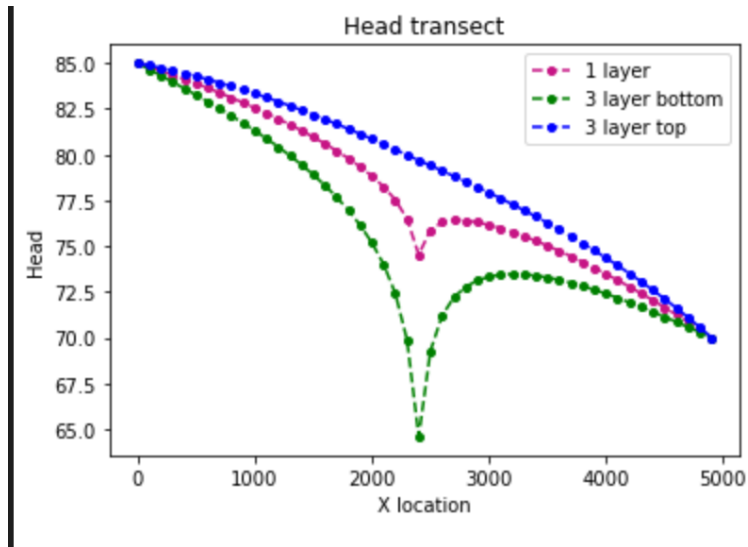


Figure 13: Head transect for each one- and three- layer model with the slant to the left.

B.

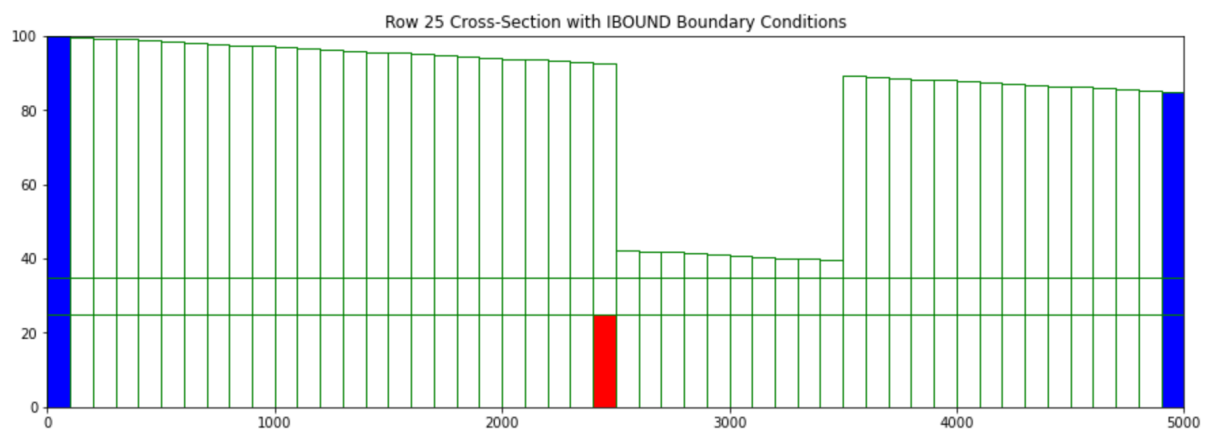


Figure 14: Topography map with a valley in the domain to the right of the well (elevation drops 50 m).

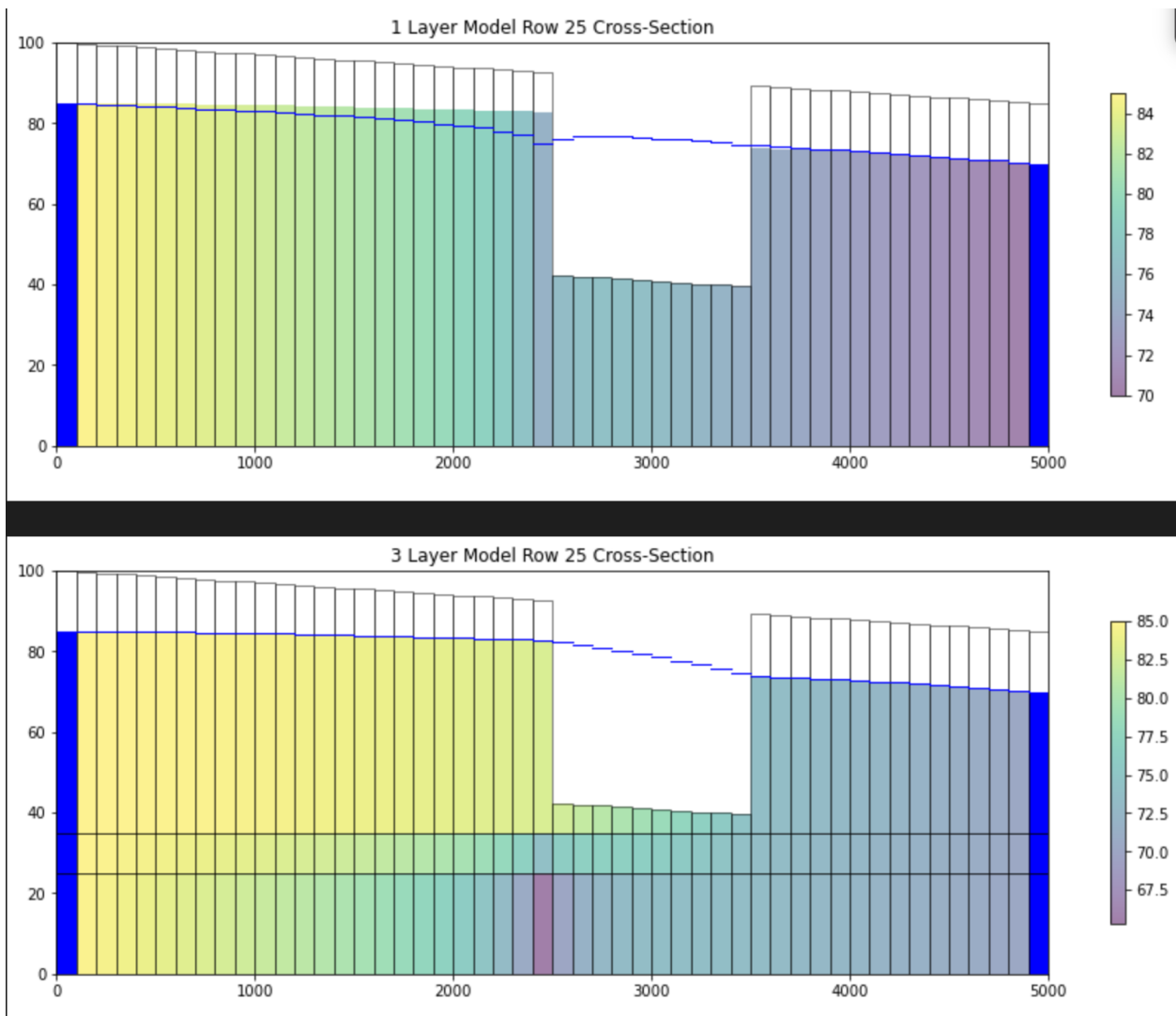


Figure 15: head contour with the two domains. The blue line depicts where the water table is and therefore we made a lake.

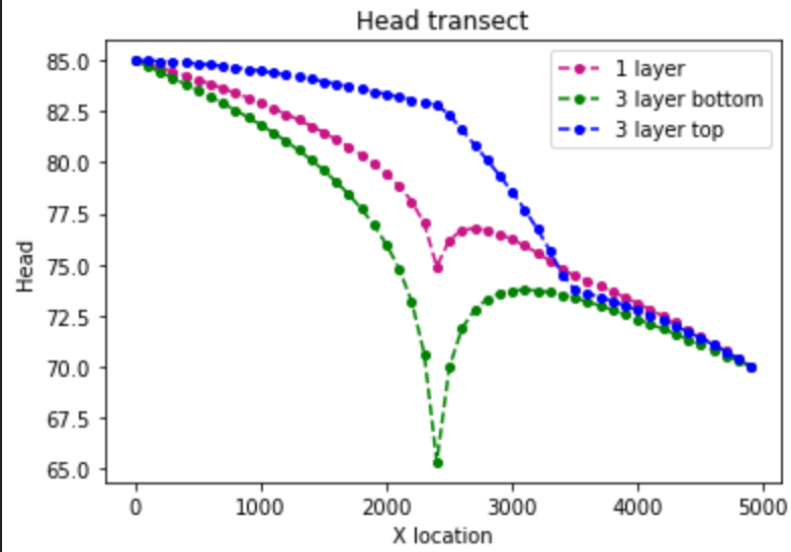


Figure 16: Head transects along one row for the valley scenario.

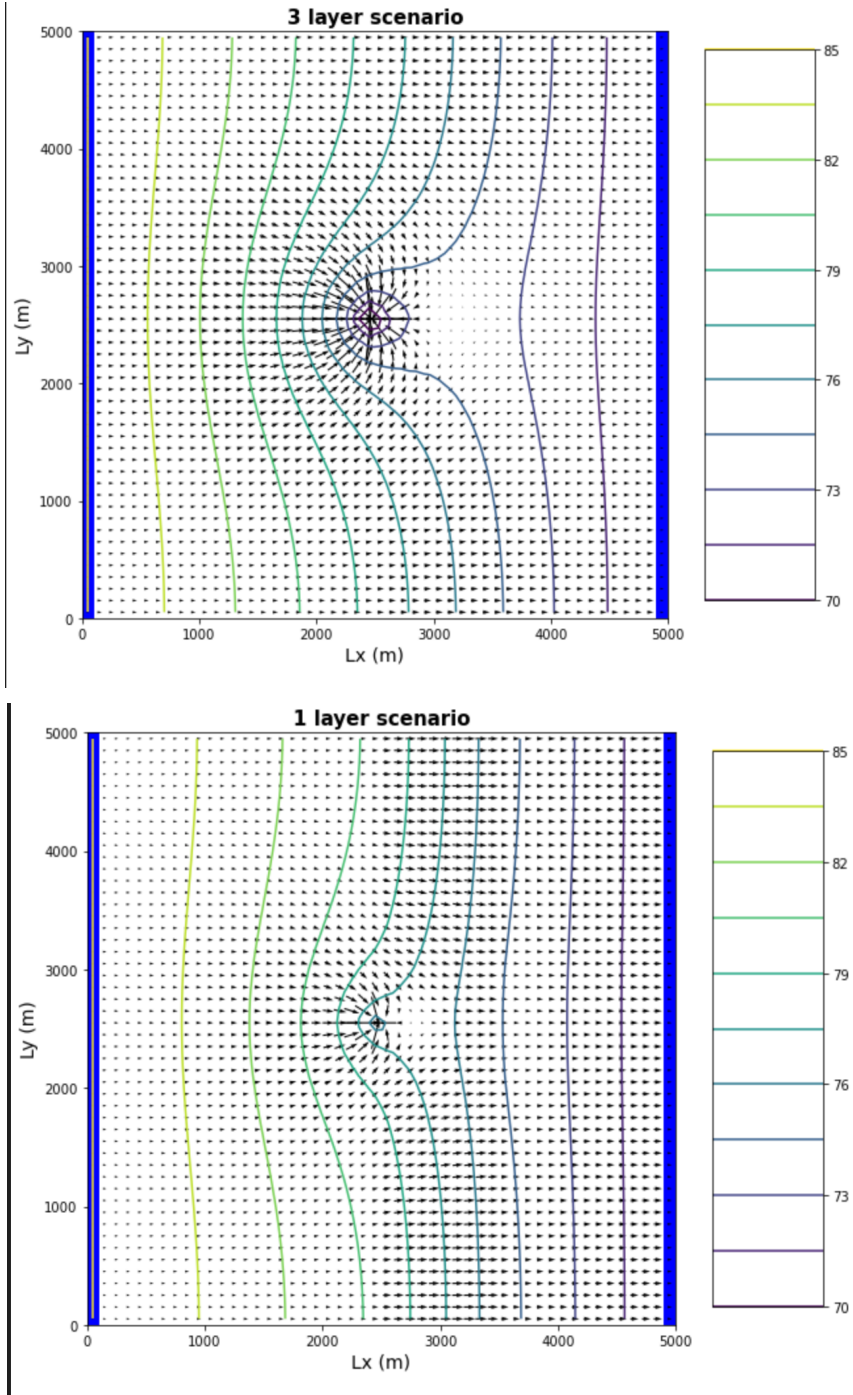


Figure 17: Pumping Wells for the Valley Scenario.