

Title:

Portion of Physical Geology lab on groundwater

Author:

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Directions:

1. Students are given pages 1-3. They will turn in pages 2 and 3 with their answers.
2. Page 5 should be copied and cut into 3 separate forms. Each student group should receive 4 data request forms.
3. Student groups will fill out a data request form and bring it to the instructor. Using the key, the instructor fills in the requested information. If the student requests the TPH test, the instructor fills that out along with the water table. The students can request the TPH test at any time after drilling.
4. Once the students receive the requested data, they enter them onto their map and determine where they want to request their next batch of data.
5. Once the students exhaust their funds, they need to prepare a report as directed (using the map and the data table and budget).

Strategies:

1. I give each group of students a rough draft map for them to write their initial findings on as well as strategize.
2. Each group of students can turn in 1 final report as a group to minimize grading.
3. I have not given student groups advice in choosing drilling locations (besides what is written in the directions), and all of them have at least partially found the contamination plume. Some groups get into fairly involved discussions, though!
4. It is best to have groups where students share decision making. I use group sizes of 3 or 4.

Groundwater Consulting

Use the information below to answer the question.

A local college learns that the level of heating oil in one of their underground storage tanks is lower than would be expected. They do not know how long this has been the case. They perform a tightness test on the tank and lines that leave it and discover that there is a leak in the system. They need to hire an environmental consulting firm to determine the extent of the leak and how to clean it up.

Your group is the group they hire. You need to first drill wells near the tank to determine if the tank actually leaked into the groundwater. Then, if there is a leak, you will need to figure out the extent of the leak by drilling more wells. For each well, you measure the elevation of the water table. You can also send the water samples to a lab for them to test for the Total Petroleum Hydrocarbons (TPH).

TPH Value	Interpretation
less than 200 ppb	Clean
between 200 and 20,000 ppb	Contaminated
more than 20,000 ppb	Very Contaminated

The company hires you for a total budget of **\$6500**. It will cost you \$1500 to write the final report for the company. It costs \$1000 to drill 4 wells, and this includes measuring the elevation of groundwater. Because you hire the driller for a day, you need to drill 4 wells at a time. The TPH test costs \$75 for each sample, and there is no daily limit.

Once your group determines the locations of the wells you want to drill, present your drill requests to your instructor. The instructor will give you the elevation of the water table in the wells. If you want to perform the TPH test, the instructor will give you the results for your wells. The TPH test can be done at any time for the wells you drill.

After determining the extent of the leak (while staying within your budget) you need to prepare a report for the college which hired you. Your report will include:

- a colored map showing
 - a. the extent of the leak (be sure to 'fill in the gaps' so your map shows where you interpret the entire leak to be, not just where you have measured it to be),
 - b. arrows showing the direction of movement,
 - c. locations of wells, and
 - d. ground water contours
- a table showing the data collected along with the budget

Company Name: _____

Final Report Map

	A	B	C	D	E	F	G	H	I	J	K	L
1									BUILDING			
2												
3												
4												
5												
6												
7												
8						TANK						
9												
10												
11												
12									BUILDING			
13												
14												
15												

Final Report Data Table and Budget

Drilling Day 1					
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Total Cost:					

Drilling Day 2					
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Total Cost:					

Drilling Day 3					
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Total Cost:					

Drilling Day 4					
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Well location:		Water Table Level (m):		TPH Test Results:	
Total Cost:					

Final Report Cost:					
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Overall Total Cost:					
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key

	A	B	C	D	E	F	G	H	I	J	K	L
1	60 20.2	90 20.4	150 20.5	170 20.6	190 20.7	160 20.8	150 20.9	80 21.1	BUILDING			
2	90 20.6	110 20.7	190 20.8	2870 20.9	11770 21.1	1830 21.2	190 21.3	90 21.4				
3	80 20.9	100 21.1	2330 21.2	12320 21.3	20850 21.4	14650 21.5	970 21.6	180 21.7				
4	70 21.3	90 21.4	1980 21.5	13160 21.6	22530 21.7	17380 21.7	2090 21.8	170 21.9	120 22.0	90 22.1	80 22.2	70 22.3
5	80 21.6	110 21.7	190 21.8	780 21.9	18110 22.0	22920 22.1	4110 22.1	190 22.2	110 22.3	70 22.3	60 22.4	40 22.5
6	90 21.9	90 22.0	180 22.1	2240 22.2	17740 22.3	24160 22.3	3760 22.4	180 22.5	100 22.6	80 22.7	50 22.8	30 22.9
7	70 22.2	80 22.3	170 22.4	1920 22.5	16290 22.6	25280 22.6	9610 22.7	190 22.8	90 22.8	70 22.9	60 22.9	40 23
8	60 22.6	70 22.7	90 22.8	160 22.8	3620 22.9	TANK		180 23.1	100 23.2	80 23.3	50 23.4	40 23.5
9	50 23.0	60 23.1	70 23.1	90 23.2	190 23.3	190 23.4	180 23.5	160 23.6	110 23.7	90 23.8	80 23.8	70 23.9
10	40 23.3	40 23.4	60 23.5	100 23.6	140 23.7	120 23.8	100 23.9	100 23.9	80 24.0	70 24.1	60 24.2	80 24.3
11	40 23.7	50 23.7	70 23.8	110 23.9	150 24.0	110 24.1	120 24.2	130 24.3	120 24.4	110 24.5	80 24.6	80 24.7
12	50 23.9	60 24.1	80 24.2	110 24.3	160 24.4	100 24.5	140 24.6	150 24.7	170 24.8	BUILDING		
13	70 24.3	80 24.5	90 24.6	130 24.7	170 24.8	120 24.9	160 25.0	180 25.0	190 25.1			
14	70 24.8	90 24.9	100 25.0	150 25.1	180 25.2	140 25.3	170 25.4	180 25.5	200 25.6			
15	80 25.2	110 25.2	120 25.3	170 25.4	190 25.5	180 25.6	180 25.7	190 25.8	200 25.9			

Top number: TPH, ppb

Bottom number: water table elevation

DATA REQUEST FORM

Company Name: _____

Well location (e.g. A-1)	Results: Water Table Level (m above sea level)	Do you want the TPH test? (This can be requested later)	Results: Total TPH (ppb)

DATA REQUEST FORM

Company Name: _____

Well location (e.g. A-1)	Results: Water Table Level (m above sea level)	Do you want the TPH test? (This can be requested later)	Results: Total TPH (ppb)

DATA REQUEST FORM

Company Name: _____

Well location (e.g. A-1)	Results: Water Table Level (m above sea level)	Do you want the TPH test? (This can be requested later)	Results: Total TPH (ppb)