

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY
CIVIL AND STRUCTURAL ENGINEERING DEPARTMENT
END OF FIRST SEMESTER EXAMINATION FOR ACADEMIC YEAR 2013/2014
CSE 553E: GROUNDWATER ABSTRACTION AND RECHARGE

INSTRUCTIONS

1. Answer question **ONE** and any other **THREE** questions
2. Explain using well labelled diagrams where necessary
3. Examination Duration: 3 Hours

QUESTION ONE (40 MARKS)

- a) State the factors that can cause equilibrium in a pumping well. **(4 marks)**
- b) Using suitable examples of subsurface formations, discuss the types of water movement that can occur in the subsurface. **(8 marks)**
- c) Explain what is done during well performance testing. **(7 marks)**
- d) Discuss how groundwater abstraction can lead to reduction in aquifer storage **(6 marks)**
- e) Discuss how basins work in artificial groundwater recharge **(6 marks)**
- f) Outline the factors that cause the build-up of water levels in a recharge well to be greater than the corresponding drawdown in a discharging well. **(4 marks)**
- g) Define “housing” in relation to a water well and enumerate the factors that are considered in designing its depth **(5 marks)**

QUESTION TWO (20 MARKS)

- a) Discuss how groundwater flows to a pumping well assuming all the other wells are located far away. **(9 marks)**
- b) Describe how the following types of wells are constructed:
 - i) Bored well **(6 marks)**

- ii) Jetted well (**5 marks**)

QUESTION THREE (20 MARKS)

- a) Briefly discuss the theory of compaction in groundwater abstraction (**9 marks**)
- b) Explain the importance of time to time maintenance and revitalization of wells (**6 marks**)
- c) Discuss how artesian and water table aquifers are screened in a borehole (**5 marks**)

QUESTION FOUR (20 MARKS)

- a) State the factors that must be considered when designing a groundwater abstraction well and what must be selected during design. (**8 marks**)
- b) Explain why a pump is needed in a producing well and discuss the type of pumps that are available for installation in a producing well mentioning the factors that influence their choice. (**12 marks**)

QUESTION FIVE (20 MARKS)

Figure 1 below represents subsurface profiles for three boreholes drilled within a radius of 3 km at a certain valley location. Topographic contours indicate that there is a gentle slope towards the valley. The depths indicated on the figure are in metres. Using the profiles:

- a) Discuss the subsurface character at the site (**6 marks**)
- b) Select one suitable method of artificial recharge for the site and using a diagram, describe the method and state reasons for the selecting it. (**7 marks**)
- c) Enumerate the possible impacts of the project (**7 marks**)

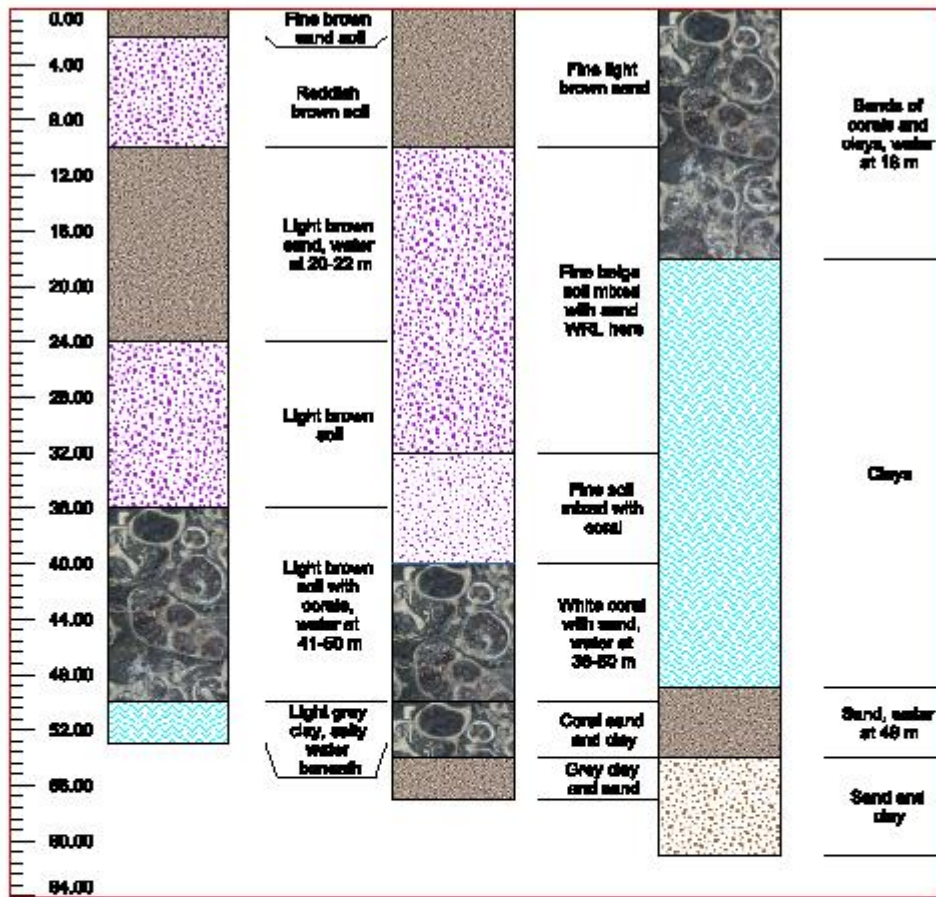


Figure 1: Subsurface profiles to be used for answering Question 5