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Continuing Education Course #039
Field and Laboratory Methods
for Stormwater Ponds

1. Typically, it is preferred to drill which type of soil boring to obtain a more reliable groundwater level measurement in an open bore-hole?

- a. standard penetration test (SPT)
- b. auger boring test
- c. cone penetration test

2. What is the minimum period of time recommended to allow stabilization of the groundwater level in the open auger boring holes after drilling?

- a. 2 hours
- b. 12 hours
- c. 24 hours
- d. 36 hours

3. The effective depth of the shallow aquifer below a retention pond can be defined by one of the following:

- a. seasonal high groundwater level
- b. bottom of unsaturated soil layer
- c. top of first low permeability soil layer
- d. bottom of clay or hardpan layer

4. The effective hydraulic influence of a retention pond, as measured from the groundwater table is:

- a. twice the width of pond
- b. twice the length of pond
- c. one width of pond
- d. one length of pond
- e. one width plus one length of pond

5. For a proposed retention pond with an average width of 35 feet and an average length of 105 feet, to be constructed on a site where the groundwater level is at 6 feet below ground surface, what is the hydraulic influence depth of the pond below the ground surface?

- a. 29 feet
- b. 41 feet
- c. 111 feet
- d. 99 feet

6. When drilling soil borings for retention pond design, it is preferred to extend the soil borings to the first confining soil layer (bottom of effective aquifer). What is the recommended maximum depth of the soil borings if the confining layer is excessively deep?

- a. 10 feet below proposed pond bottom
- b. 50 feet below proposed pond bottom

○ c. one width of pond as measured below the groundwater table
○ d. one width of pond as measured below the pond bottom

7. What is the minimum number of soil borings recommended for the investigation of a retention pond?
○ a. 1
○ b. 2
○ c. 4
○ d. 6

8. If a confining soil layer is not encountered within the drilled depth of the soil borings, the bottom of the effective aquifer shall be set at:
○ a. the groundwater table
○ b. 10 feet below the pond bottom
○ c. 10 feet below the groundwater table
○ d. the bottom of the soil borings

9. Which factor(s) affect the selection of a minimum number of soil borings needed to be drilled for a stormwater retention pond?
○ a. variability of subsurface conditions
○ b. size of retention pond
○ c. sensitivity of downstream drainage system
○ d. regulatory criteria
○ e. all of the above

10. For a retention pond 120 feet wide and 200 feet long, calculate the minimum number of soil boring tests using the empirical equation included in this course.
○ a. 1
○ b. 2
○ c. 3
○ d. 4

11. For a retention pond 500 feet wide and 850 feet long, calculate the minimum number of soil boring tests using the empirical equation included in this course.
○ a. 2
○ b. 5
○ c. 6
○ d. 8

12. For a retention pond 50 feet wide and 1,200 feet long, calculate the minimum number of soil boring tests using the empirical equation included in this course.
○ a. 2
○ b. 4
○ c. 6
○ d. 7

13. Which one of the following factors DOES NOT affect the hydraulic conductivity value?
○ a. viscosity of water
○ b. grain size distribution of the soil
○ c. density of the soil
○ d. size of retention pond
○ e. degree of soil saturation

14. It is easy to collect undisturbed tube soil samples in sandy soil strata below the groundwater level.
- a. True
- b. False

15. When conducting an open-hole or piezometer hydraulic conductivity test on soils ABOVE the groundwater table, water must be added to the open-hole or piezometer instead of pumped out.
- a. True
- b. False

16. The Bureau of Reclamation (1974) recommends a hydraulic conductivity test method where an uncased borehole (or borehole stabilized by piezometer) is used. This method is also known as:
- a. the slug test method
- b. the well permeameter method
- c. the time-lag method
- d. the pump test method

17. A total of 4 soil borings were drilled for a retention pond investigation. Calculate the minimum number of hydraulic conductivity tests needed, using the empirical equation included in this course.
- a. 1
- b. 2
- c. 3
- d. 4

18. Hvorslev (1951) conducted studies for the U.S. Corp of Engineers to measure hydraulic conductivity from soil borings, cased boreholes and piezometers. His method is also referred to as the:
- a. slug test
- b. constant head test
- c. time-lag test
- d. piezometer test

19. To conduct a pumping test in a shallow unconfined sandy aquifer system, it is required to install a minimum of:
- a. 1 well or piezometer
- b. 2 wells or piezometers
- c. 3 wells or piezometers
- d. 4 wells or piezometers

20. For a pumping test with one pumping well and one observation well, the minimum pumping time required to produce reliable results is:
- a. 20 minutes
- b. 60 minutes
- c. 2 hours
- d. 5 hours
- e. 8 hours

21. For best aquifer characterization, both standard penetration test borings and auger borings are recommended to be drilled.
- a. True
- b. False

22. When calculating the weighted average vertical hydraulic conductivity for retention pond design, which soil layers should be included?

○ a. soil layers between pond bottom and groundwater level
○ b. all soil layers within the effective aquifer
○ c. soil layers between groundwater level and bottom of aquifer
○ d. soil layers between pond bottom and design high water level of pond

23. Which of the following equations apply to calculating the weighted average horizontal hydraulic conductivity?

○ a. $$\frac{2g}{vC_s} D^2 \frac{e^3}{1+e}$$

○ b. $$\frac{\sum L}{\frac{L_1}{Kv_1} + \frac{L_2}{Kv_2} + \frac{L_3}{Kv_3} + \ldots\ldots\ldots \frac{L_n}{Kv_n}}$$

○ c. $$\frac{Kh_1.L_1 + Kh_2.L_2 + Kh_3.L_3 + \ldots.Kh_n.L_n}{\sum L}$$

24. Which of the following equations apply to calculating the weighted average vertical hydraulic conductivity?

○ a. $$\frac{2g}{vC_s} D^2 \frac{e^3}{1+e}$$

○ b. $$\frac{\sum L}{\frac{L_1}{Kv_1} + \frac{L_2}{Kv_2} + \frac{L_3}{Kv_3} + \ldots\ldots\ldots \frac{L_n}{Kv_n}}$$

○ c. $$\frac{Kh_1.L_1 + Kh_2.L_2 + Kh_3.L_3 + ....Kh_n.L_n}{\sum L}$$

25. A total of 7 soil borings were drilled for a retention pond investigation. Calculate the minimum number of hydraulic conductivity tests needed, using the empirical equation included in this course.

○ a. 1
○ b. 2
○ c. 3
○ d. 4

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