



These problems address topics from the NCEES FE Civil CBT Exam Specifications at <https://ncees.org/wp-content/uploads/FE-Civil-CBT-specs-1.pdf>, see below.

FE Civil Review 2022

Water Resources Engineering

NCEES Fundamentals of Engineering (FE)

CIVIL CBT Exam Specifications

Effective Beginning with the July 2020 Examinations



Knowledge	Number of Questions
10. Water Resources and Environmental Engineering A. Basic hydrology (e.g., infiltration, rainfall, runoff, watersheds) B. Basic hydraulics (e.g., Manning equation, Bernoulli theorem, open-channel flow) C. Pumps D. Water distribution systems E. Flood control (e.g., dams, routing, spillways) F. Stormwater (e.g., detention, routing, quality)	10-15
G. Collection systems (e.g., wastewater, stormwater) H. Groundwater (e.g., flow, wells, drawdown) I. Water quality (e.g., ground and surface, basic water chemistry) J. Testing and standards (e.g., water, wastewater, air, noise) K. Water and wastewater treatment (e.g., biological processes, softening, drinking water treatment)	Hydrology and Hydraulics Environmental Engineering

Notes

V1.0 published 3/22/2022

V1.1 minor update to problem 17, 3/22/2022

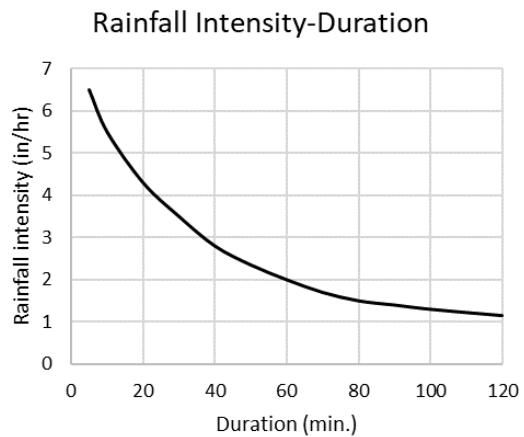
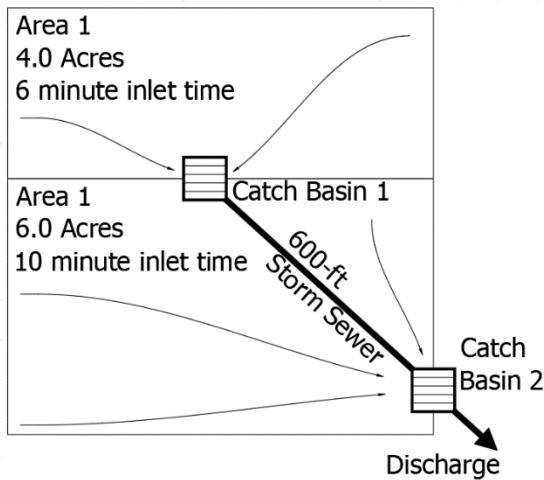
V1.2 title sheet 3/29/2022

V1.3 update to problem 7 6/13/22



A. Basic hydrology

Question 1: A project site is determined to have a rainfall intensity for its design storm as shown in the curve below. This site is a total of 10 acres that drains to two separate catch basins prior to reaching a discharge point. The composite rainfall coefficient for the entire area is approximately 0.4 and a velocity of 2 ft/sec is assumed in the storm sewers. Based on the parameters given, the discharge from the site is most nearly:



- A. 17 cfs
- B. 19 cfs
- C. 20 cfs
- D. 22 cfs



A. Basic hydrology

Question 2: A residential development is composed of pavement, lawn and open area with CN values given below. For a 100-year storm that produces approximately 7-inches of rainfall, the discharge from the site (assuming no other inflow) is most nearly:

Description	Area (Acres)	CN
Open space (lawns, good condition)	2.5	74
Residential (1/2 acre lots)	8.5	80
Impervious areas	1.5	98

- A. 4.8 inches
- B. 5.1 inches
- C. 5.7 inches
- D. 7.0 inches

A. Basic hydrology

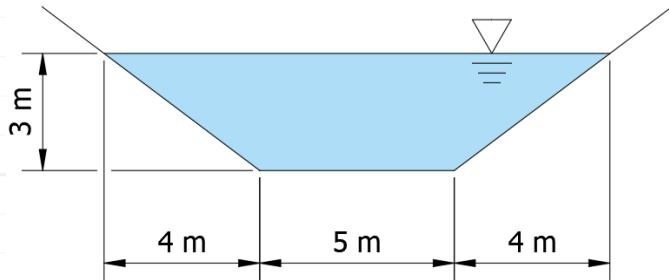
Question 3: In stormwater management, the initial abstraction accounts for all of the following, except:

- A. infiltration
- B. evaporation
- C. retention
- D. runoff



B. Basic hydraulics

Question 4: A concrete-lined channel is used to convey water flow between Point A at a surface elevation of 510 m and point B at surface elevation of 508 m above sea level over a distance of 2 kilometers. The surface roughness coefficient of the concrete is 0.012. The flow conveyed by this channel in m^3/sec is most nearly:



- A. 70
- B. 105
- C. 150
- D. 165

B. Basic hydraulics

Question 5: An 8-foot wide rectangular channel carries 200 cubic feet per second of water at a depth of 1.5 feet before entering a hydraulic jump. The water depth downstream of the jump is most nearly:

- A. 2.4 ft
- B. 2.7 ft
- C. 3.4 ft
- D. 4.4 ft



C. Pumps

Question 6: A pump is used to lift water from a reservoir with a surface elevation of 210 feet to an outlet elevation of 235 feet with discharge pressure of 50 psi. The pump flow is 100 gallons per minute and uses a 2-1/2-inch diameter hose with a C value of 135. The distance from the pump to the outlet is 200 feet. Head loss due to fittings is approximately 5 feet. To supply 100 gpm at 50 psi at the outlet, the pump pressure in psi is most nearly:

- A. 20
- B. 40
- C. 50
- D. 70



D. Water distribution systems:

Question 7: A flow test is performed at a fire hydrant to determine the flow rating at a pressure of 20 psi. The static pressure at the hydrant is 70 psi. The test uses a hydrant with a 2.5-inch orifice with a square outlet projecting into the barrel of the hydrant. A pitot pressure of 45 psi and a residual pressure of 45 psi are observed during the test. The maximum flow rate that this system can provide at 20 psi is most nearly:

- A. 875 gpm
- B. 1270 gpm
- C. 1560 gpm
- D. 3500 gpm



E. Flood control

Question 8: The purpose of an emergency spillway is most closely:

- A. To lower reservoir levels in anticipation of a significant rainfall event that could cause flooding.
- B. To divert flows from a reservoir, if a dam safety inspection indicates a dam's principal is in an unsafe condition.
- C. To divert reservoir flows so that emergency responders can safely access a water body in the event of a drowning or other serious injury.
- D. To allow flow to pass that exceeds the capacity of the principal spillway and protect the dam in the event of a flood.

E. Flood control

Question 9: A weir must be sized at pond with to pass flow into an emergency spillway for flood control. Given a weir width of 10 ft, which is smaller than the width of the channel, the approximate depth of flow required to pass 125 cfs is most nearly:

- A. 1'-6"
- B. 2'-0"
- C. 2'-6"
- D. 3'-0"



F. Stormwater

Question 10: Characteristics that lead to eutrophication of a water body include all the following except:

- A. nitrogen and phosphorous rich runoff
- B. sediment deposition which reduces the volume of a water body
- C. high levels of dissolved oxygen
- D. an overabundance of plants and nutrients

F. Stormwater

Question 11: Standard Stormwater Management Practices (SMPs) for water quality controls consider all the following, except:

- A. Capture and treat 100% of the water quality volume
- B. Achieve 80% reduction in TSS and 40% reduction in TP
- C. Maintain 100-year design storm peak site discharge flow to levels to a pre-construction level
- D. Include a pretreatment mechanism and a maintenance plan



G. Collection Systems

Question 12: To provide a minimum velocity, when half-full, of 2.0 feet per second in a 12-inch diameter sewer pipe with an "n" value of 0.013, the drop per 100 feet must be most nearly:

- A. 0.02
- B. 0.15
- C. 0.20
- D. 0.44

H. Groundwater

Question 13: Soil testing indicates the presence of an unconfined aquifer with a depth of 180 feet above an impermeable layer. Three wells are installed 400 feet apart in the soil. One well is used to pump water and the other two are used to monitor the drawn down. A pump with discharge of 50 gallons per minute achieves a steady state where the drawdown is 15 feet and 11 feet at 400 feet and 800 feet respectively from the pumping well. The hydraulic conductivity in the soil in ft/day is most nearly:

- A. 1.1
- B. 1.6
- C. 1.9
- D. 2.2



I. Water quality

Question 14: The primary purpose of the federal National Discharge Pollutant Elimination System in the United States is which of the following:

- A. Limit and control pollutants from point source discharges to waters of the United States
- B. Develop new technologies to research and mitigate impacts of deleterious pollutants
- C. Establish standards for maximum contaminant levels for safe drinking water
- D. Provide aid to communities to construct and maintain treatment plants for elimination of pollutants

I. Water quality

Question 15: Lime-soda softening is used to remove calcium carbonate hardness for a given water source. Lime with a purity of 80% $\text{Ca}(\text{OH})_2$ to precipitate CaCO_3 . The dosage of lime required to combine with 50 mg/L of calcium is most nearly:

- A. 74 mg/L
- B. 92 mg/L
- C. 115 mg/L
- D. 162 mg/L



J. Testing and standards

Question 16: An unseeded domestic wastewater BOD test is performed. A 6-mL sample of wastewater is diluted in a 300-mL test bottle. Initially, the dissolved oxygen content is measured as 8.0 mg/L. After 5 days, the dissolved oxygen is 4.0 mg/L. If the k-rate is 0.30 per day, the ultimate BOD in mg/L is most nearly:

- A. 150
- B. 207
- C. 257
- D. 300

K. Water and wastewater treatment

Question 17: A chemical analysis of a water sample indicates Ca^{++} is at a concentration of 10 mg/L and Mg^{++} is at a concentration of 25 mg/L. The total hardness of the water expressed as CaCO_3 is most nearly:

- A. 35.0
- B. 58.5
- C. 102.5
- D. 127.5