Certification Boulevard Answer Key

From page 34

1. **b. 261,800 gals**
   Volume, gals
   = Length, feet x Width, feet x Depth, feet = cubic feet (ft³)
   = cubic feet x 7.48 gals per ft³
   = 100 feet x 25 feet x 14 feet
   = 35,000 ft³
   = 35,000 ft³ x 7.48 gal/ft³
   = 261,800 gallons

2. **a. 98.6%**
   Percent Removal Efficiency
   = ((In – Out)÷ In) x 100 = %
   = ((250 ppm – 3.5 ppm) ÷ 250 ppm) x 100
   = 98.6%

3. **b. 0.21**
   F/M Ratio
   = (F = Influent CBOD₅, lbs/day)÷ (M = Aeration MLVSS, lbs)
   Lbs/day CBOD₅ (F)
   = Flow, mgd x conc., ppm x 8.34 lbs/gal
   = 0.575 mgd x 250 ppm x 8.34 lbs/gal
   = 1,199 lbs/day CBOD₅
   Lbs MLVSS (M)
   = Aeration Tank Volume, mg x MLVSS, ppm x 8.34 lbs/gal
   = (261,800 gals x 1,000,000) x (3,500 ppm x 0.75) x 8.34 lbs/gal
   = 0.2618 mg x 2,625 ppm x 8.34 lbs/gal
   = 5,731 lbs MLVSS
   = (F = 1,199 CBOD₅, lbs/day) ÷ (M = 5,731 MLVSS, lbs)

= 0.21 F/M ratio

4. **d. 1,963 ft²**
   Surface Area
   = πr²
   = 3.14 x 25 feet, x 25 feet
   = 1,963 ft²

5. **c. 6.5 days**
   SRT, days
   = Pounds MLSS Inventory in Aeration ÷ Lbs/day TSS Removed from the Process
   Pounds MLSS in Aeration
   = Aeration Tank Volume, mg x MLSS, ppm x 8.34 lbs/gal
   = 0.2618 mg x 3,500 ppm x 8.34 lbs/gal
   = 7,642 lbs MLSS in Aeration
   Lbs/day TSS Removed
   = Lbs/day WAS TSS + Lbs/day Final Eff TSS
   Lbs/day WAS TSS
   = WAS, mgd x WAS conc., ppm x 8.34 lbs/gal
   = 0.014 mgd x 10,000 ppm x 8.34 lbs/gal
   = 1,168 lbs/day WAS TSS
   Lbs/day Eff TSS
   = Q, mgd x Eff TSS, ppm x 8.34 lbs/gal
   = 0.575 mgd x 2.5 ppm x 8.34 lbs/gal
   = 12 lbs/day Eff TSS
   SRT, days
   = 7,642 lbs MLSS in Aeration ÷ (1,168 lbs/day WAS TSS + 12 lbs/day Eff TSS)
   = 6.5 day SRT

6. **c. 0.316 mgd**
   RAS Rate, mgd
   = Q, mgd x RAS % of Q
   = 0.575 mgd x 0.55

= 0.316 mgd RAS Rate

7. **d. 1,168 lbs/day**
   WAS Removed, Lbs/day
   = QWAS, mgd x WAS conc., ppm x 8.34 lbs/gal
   QWAS, mgd
   = 14,000 gpd ÷ 1,000,000
   = 0.014 mgd
   WAS Conc., ppm
   = 1% x 10,000 ppm
   = 10,000 ppm
   WAS Removed, Lbs/day
   = 0.014 mgd x 10,000 ppm x 8.34 lbs/gal
   = 1,168 lbs/day WAS

8. **a. 13.2 lbs/day/ft²**
   Clarifier Solids Loading Rate, lbs/day/ft²
   = Total MLSS Entering Clarifier, lbs/day ÷ Clarifier Surface Area, ft²
   Total MLSS Entering Clarifier, lbs/day
   = Q + QR, mgd x MLSS, ppm x 8.34 lbs/gal
   = 0.575 + 0.316 mgd x 3,500 ppm x 8.34 lbs/gal
   = 26,008 lbs/day MLSS entering clarifier
   Clarifier Surface Area, ft²
   = πr²
   = 3.14 x 25 ft x 25 ft
   = 1,963 ft²
   Clarifier Solids Loading Rate, lbs/day/ft²
   = 26,008 MLSS Entering Clarifier, lbs/day ÷ 1,963 ft² Surface Area
   = 13.2 lbs/day/ft²

9. **a. 98.8%**
   Percent Removal Efficiency
   = ((In – Out)÷ In) x 100 = %

= ((200 ppm – 2.5 ppm) ÷ 200 ppm) x 100
= 98.75%

10. **d. 9.0 hours**
    Detention Time, hours
    = V/Q = Tank Volume, mg x 24 hrs/day ÷ Influent Flow Entering Tank, mgd
    Aeration Volume, mg
    = 100 ft long x 25 ft wide x 14 ft deep x 7.48 gal/ft³
    = 261,800 gals ÷ 1,000,000
    = 0.2618 mg
    Inf Flow Entering Tank, mgd
    = 575,000 gpd ÷ 1,000,000
    = 0.575 mgd
    Detention Time, hours
    = (0.2168 mg tank volume ÷ 0.575 mgd Inf Flow) x 24 hrs/day
    = 9.0 hours

11. **d. 157 feet**
    Length of Weir, feet
    = Circumference = πd
    = 3.14 x 50 ft diameter
    = 157 feet

12. **b. 3,662 gpd/ft of weir**
    Weir Overflow Rate
    = Influent Flow Entering Clarifier, gpd ÷ Total Length of Weir, feet
    = 575,000 gpd ÷ 157 feet
    = 3,662 gpd per foot of weir

13. **c. 293 gpd/ft²**
    Surface Settling Rate, gpd/ft²
    = Influent Flow Entering Clarifier, gpd ÷ Surface Area, ft²
    = 575,000 gpd ÷ 1,963 ft²
    = 292.9 gpd/ft²