

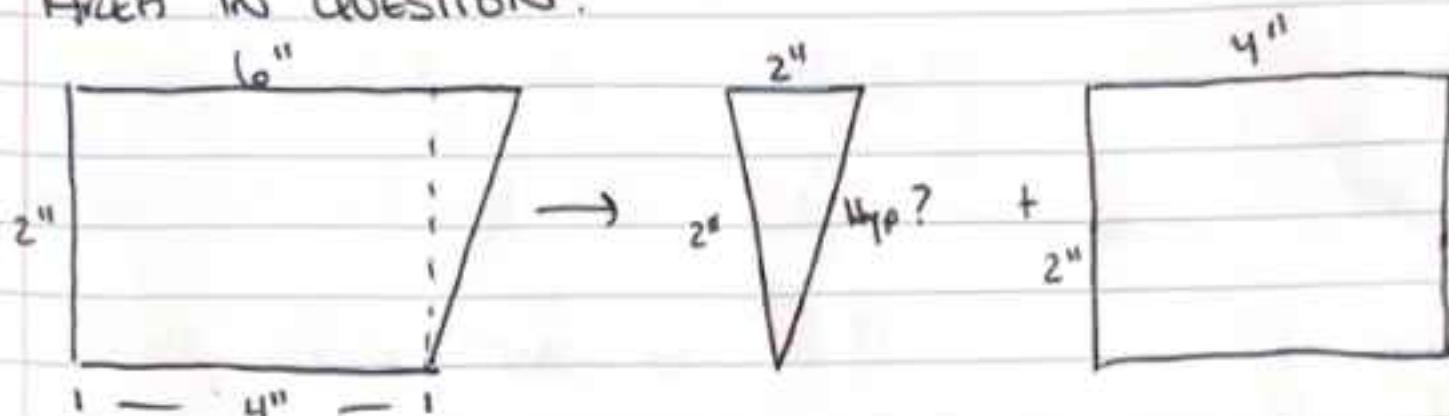
HW 2.3 CH. 14 6, 15, 21, 36, 42

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6) FIND HYDRAULIC RADIUS (R)?

GIVEN: WATER FLOWS @ A DEPTH OF 2".

AREA IN QUESTION:



$$R = A/WP: \quad A_T = \frac{1}{2}(2)(2) = 2 \text{ in}^2 \quad \Rightarrow A_T = 10 \text{ in}^2$$

$$A_R = (4)(2) = 8 \text{ in}^2$$

$$Hyp. = \sqrt{2^2 + 2^2} = 2.83 \text{ in}$$

$$WP = 2 \text{ in} + 4 \text{ in} + 2.83 \text{ in} = 8.83 \text{ in}$$

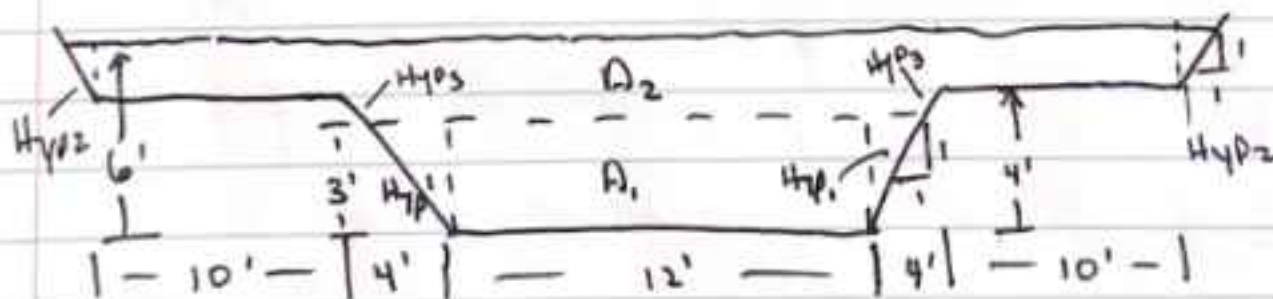
$$\Rightarrow R = 10 \text{ in}^2 / 8.83 \text{ in} = \boxed{1.13 \text{ in}}$$

15) DETERMINE Q @ 3 & 6 ft

GIVEN: $N = 0.04$, $S = .00015$

$$Q = (1.49/n) A S^{1/2} R^{2/3}$$

$$R = A/WP$$



$$A_1 = (3')(3') = 9 \text{ ft}^2 + (12')(3') = 45 \text{ ft}^2$$

$$Hyp_1 = \sqrt{3^2 + 4^2} (2) = 8.49 \text{ ft}$$

$$\Rightarrow R = 45 \text{ ft}^2 / 20.49 \text{ ft} = 2.20 \text{ ft}$$

$$\Rightarrow WP_{A_1} = 8.49 \text{ ft} + 12 \text{ ft} = 20.49 \text{ ft}$$

$$\Rightarrow Q_{3ft} = (1.49 / .04) (45 \text{ ft}^2) (.00015)^{1/2} (2.20)^{2/3}$$

$$\Rightarrow \boxed{Q_{3ft} = 34.73 \text{ ft}^3/\text{s}}$$

→ CONT

$$15) A_2 = 4'(4') + 4'(12') + 2'(2') + 2'(40') = 148 \text{ ft}^2$$

$$\text{CWT } H_{p2} = \sqrt{2^2 + 2^2} (2) = 5.66 \text{ ft}$$

$$H_{p3} = \sqrt{4^2 + 4^2} (2) = 11.31 \text{ ft}$$

$$WP = 5.66' + 10' + 11.31' + 12' + 10' = 48.97'$$

$$R = 148 \text{ ft}^2 / 48.97' = 3.02'$$

$$\Rightarrow Q = (1.49 / 1.04) (148) (.00015)^{1/2} (3.02)^{2/3} \Rightarrow \boxed{Q_{\text{eff}} = 141.04 \text{ ft}^3/\text{s}}$$

21) FIND SIZE OF DRAINAGE TILE?

GIVEN: ROUND common Clay $\rightarrow n = .013$

$S = .001$, RUNNING $1/2$ full

$$Q = \frac{500 \text{ gal}}{\text{min}} \times \frac{1 \text{ ft}^3}{7.48 \text{ gal}} = 1.1 \text{ ft}^3/\text{s}$$

$$A = \pi D^2 / 4 (1/2) = \pi D^2 / 8 \Rightarrow R = A / WP = D / 4$$

$$WP = \pi D / 2$$

$$\Rightarrow \frac{nQ}{1.49 (S^{1/2})} = AR^{2/3} \Rightarrow \frac{nQ}{1.49 (S^{1/2})} = \frac{\pi D^2}{8} \left(\frac{D}{4} \right)^{2/3}$$

$$\Rightarrow \frac{nQ}{1.49 (S^{1/2})} = \frac{\pi D^{8/3}}{20.16} \Rightarrow \frac{20.16}{\pi} \frac{.013}{1.49} \frac{1.1}{.001^{1/2}} = D^{8/3}$$

$$\Rightarrow \boxed{D = 1.29 \text{ ft}}$$

36) DESIGN CHANNEL FOR TABLE 14.3 $\rightarrow A, WP, R, y_h$

GIVEN: $Q = 1.25 \text{ ft}^3/\text{s}$, $V = 2.75 \text{ ft/s}$

$$\Rightarrow A = Q / V = \frac{1.25 \text{ ft}^3/\text{s}}{2.75 \text{ ft/s}} = .455 \text{ ft}^2$$

RECTANGLE:

$$.455 \text{ ft}^2 = 2y^2$$

$$\Rightarrow y = .477 \text{ ft} \star$$

$$T = .954 \text{ ft} \star$$

$$\boxed{A = .455 \text{ ft}^2}$$

$$WP = 4y$$

$$\Rightarrow \boxed{WP = 1.908 \text{ ft}}$$

$$y_h = A / T = .455 \text{ ft}^2 / .954 \text{ ft}$$

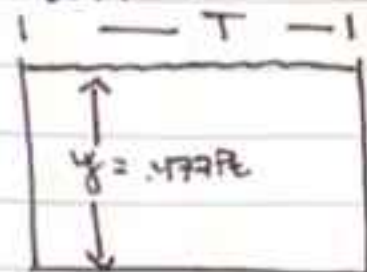
$$\Rightarrow \boxed{y_h = .477 \text{ ft}}$$

$$R = A / WP = .455 \text{ ft}^2 / 1.908 \text{ ft}$$

$$\boxed{R = .238 \text{ ft}}$$

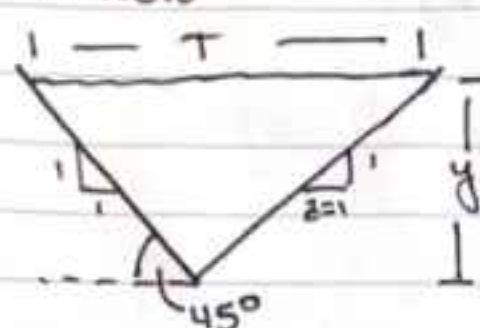
36
Cont

RECT.



$$T=b=0.954 \text{ ft}$$

TRIANGLE



$$A=0.455 \text{ ft}^2$$

$$\Rightarrow y^2 = 0.455 \text{ ft}^2 \Rightarrow y = 0.675' \quad \star$$

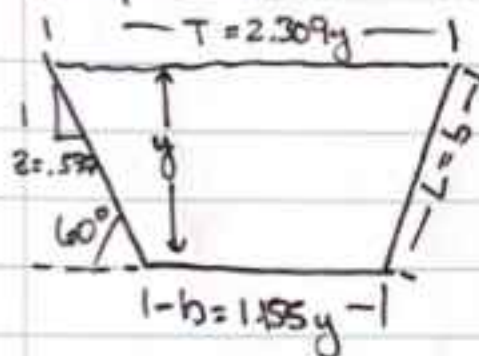
$$WP = 2.83(0.675') = 1.91'$$

$$R = A/WP = 0.455' / 1.91' = 0.238$$

$$T = 2y = 2(0.675') = 1.35' \quad \star$$

$$y_h = A/T = 0.455 \text{ ft}^2 / 1.35 \text{ ft} = 0.337 \text{ ft}$$

TRAPEZOID



$$A=0.455 \text{ ft}^2$$

$$1.73y^2 = 0.455 \text{ ft}^2 \Rightarrow y = 0.513 \text{ ft} \quad \star$$

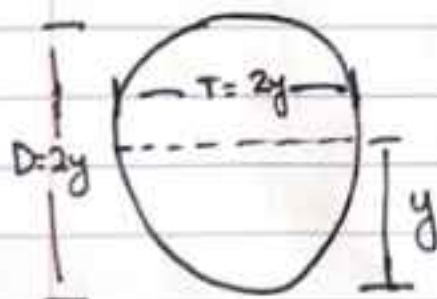
$$WP = 3.46y = 3.46(0.513 \text{ ft}) = 1.775 \text{ ft}$$

$$R = y/2 = 0.513 \text{ ft} / 2 = 0.2565 \text{ ft}$$

$$T = 2.309y = 2.309(0.513 \text{ ft}) = 1.185 \text{ ft} \quad \star$$

$$b = 1.155y = 1.155(0.513 \text{ ft}) = 0.593 \text{ ft} \quad \star$$

SEMI CIRCLE



$$A=0.455 \text{ ft}^2$$

$$\frac{\pi y^2}{2} = 0.455 \text{ ft}^2 \Rightarrow y = 0.538 \text{ ft} \quad \star$$

$$WP = \pi y = \pi(0.538 \text{ ft}) = 1.69 \text{ ft}$$

$$R = y/2 = 0.538 \text{ ft} / 2 = 0.269 \text{ ft}$$

$$D=T=2y = 2(0.538) = 1.076 \text{ ft} \quad \star$$

$$y_h = A/T = 0.455 \text{ ft}^2 / 1.076 \text{ ft} = 0.423 \text{ ft}$$