For the exclusive use of adopters of the book Water-Resources Engineering, Second Edition, by David A. Chin.
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$$
\begin{aligned}
\frac{1}{n_e}\frac{A^{5/3}}{P^{2/3}} &= \sum_{i=1}^{N}\frac{1}{n_i}\frac{A_i^{5/3}}{P_i^{2/3}} \\
\frac{1}{n_e}PR^{5/3} &= \sum_{i=1}^{N}\frac{1}{n_i}P_iR_i^{5/3}
\end{aligned}
$$

which simplifies to

$$
\boxed{n_e = \frac{PR^{5/3}}{\sum_{i=1}^{N}\frac{P_iR_i^{5/3}}{n_i}}}
$$

3.19. From the given shape of the floodplain (Figure 3.5), the following geometric characteristics are derived:

Section, i	P_i (m)	A_i (m^2)	R_i (m)	n_i	y_i (m)
1	20.6	50	2.42	0.040	2.50
2	100.0	500	5.00	0.030	5.00
3	6.7	39	5.81	0.015	6.50
4	15.0	120	8.00	0.013	8.00
5	6.7	39	5.81	0.017	6.50
6	150.0	750	5.00	0.035	5.00
7	20.6	50	2.42	0.060	2.50
	319.6	1548			

The total perimeter, P, of the (compound) channel is 319.6 m, the total area, A, is 1548 m^2, and hence the hydraulic radius, R, of the compound section is given by

$$
R = \frac{A}{P} = \frac{1548}{319.6} = 4.84 \text{ m}
$$

Substituting these data into the formulae listed in Table 3.2 yields the following results:

Formula	n_e
Horton/Einstein	0.034
Muhlhofer/Einstein and Banks	0.035
Lotter	0.026
Krishnamurthy and Christensen	0.029
Average	0.031

A conservative (high) estimate of the composite roughness is 0.035, and the average composite roughness predicted by the models is $\boxed{0.031}$.

3.20. In the main channel: $n = 0.016$ and $S_o = 0.005$. When the main channel flows full:

$$
\begin{aligned}
A &= \frac{1}{2}[30+30+3(2)+3(3)](3) = 112.5 \text{ m}^2 \\
P &= 30+3(\sqrt{3^2+1^2}+\sqrt{2^2+1^2}) = 46.2 \text{ m} \\
R &= \frac{A}{P} = \frac{112.5}{46.2} = 2.44 \text{ m}
\end{aligned}
$$