$$
\begin{aligned}
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& \text { For the exclusive use of adopters of the book Water-Resources Engineering, Second Edition, } \\
& \text { by David A. Chin. } \\
& \text { ISBN 0-13-148192-4. }
\end{aligned}
$$

3.26. From the given data: $Q=50 \mathrm{~m}^{3} / \mathrm{s}, b=4 \mathrm{~m}$, and $m=1.5$. Under critical flow conditions

$$
\frac{Q^{2}}{g}=\frac{A^{3}}{T}
$$

which gives

$$
\frac{50^{2}}{9.81}=\frac{\left(4 y_{c}+1.5 y_{c}^{2}\right)^{3}}{4+2(1.5) y_{c}}
$$

Solving by trial and error yields

$$
y_{c}=1.96 \mathrm{~m}
$$

When $y=3 \mathrm{~m}$, the Froude number, Fr, is given by the relation

$$
\begin{aligned}
\operatorname{Fr}^{2} & =\frac{Q^{2} T}{g A^{3}} \\
& =\frac{(50)^{2}(4+2 \times 1.5 \times 3)}{(9.81)\left(4 \times 3+1.5 \times 3^{2}\right)^{3}}=0.19
\end{aligned}
$$

hence

$$
\mathrm{Fr}=0.45
$$

and the flow is subcritical.
3.27. From the given data: $w_{1}=2 \mathrm{~m}, Q=3 \mathrm{~m}^{3} / \mathrm{s}, y_{1}=1.2 \mathrm{~m}$, and $w_{2}=w_{1}-0.4 \mathrm{~m}=1.6 \mathrm{~m}$. Conservation of energy requires that

$$
y_{1}+\frac{V_{1}^{2}}{2 g}=y_{2}+\frac{V_{2}^{2}}{2 g}
$$

where

$$
\begin{aligned}
& V_{1}=\frac{Q}{A_{1}}=\frac{Q}{w_{1} y_{1}}=\frac{3}{(2)(1.2)}=1.25 \mathrm{~m} / \mathrm{s} \\
& V_{2}=\frac{Q}{A_{2}}=\frac{Q}{w_{2} y_{2}}=\frac{3}{1.6 y_{2}}=\frac{1.875}{y_{2}} \mathrm{~m} / \mathrm{s}
\end{aligned}
$$

Substituting into the energy equation gives

$$
\begin{aligned}
1.2+\frac{1.25^{2}}{2(9.81)} & =y_{2}+\frac{\left(1.875 / y_{2}\right)^{2}}{2(9.81)} \\
1.28 & =y_{2}+\frac{0.179}{y_{2}^{2}}
\end{aligned}
$$

Solving for $y_{2}$ gives

$$
y_{2}=0.47 \mathrm{~m}, 1.14 \mathrm{~m}
$$

These depths correspond to supercritical and subcritical flow conditions respectively. Since the upstream flow is subcritical, the flow in the constriction must also be subcritical, hence

$$
y_{2}=1.14 \mathrm{~m}
$$

