

Chicago Drainage Canal.

RECAPITULATION.

Discharge of Chicago Drainage Channel with a

Depth of 22 feet.....	12,448 cubic feet per second.		
“ 23 “	13,460	“	“
“ 24 “	14,400	“	“
“ 24.6 “	15,066	“	“
“ 25 “	15,480	“	“
“ 26 “	16,560	“	“
“ 27 “	17,540	“	“

THE ELEVATION OF BACKWATER CAUSED BY CHANNEL CONTRACTION.

Let

Y = Elevation of water surface immediately behind the contracted channel. In this case = 1.75 feet.

y = Elevation at any other point up stream.

i = Slope of bottom of uncontracted channel or pond.

s = Distance up stream from the point of contraction. In this case at Robey Street junction = 70,000 feet.

1.—Guilhelm's Formula.

$$\begin{aligned}
 y &= Y \sqrt[3]{\frac{1}{1 + \frac{1}{2} Y \left(\frac{i s}{Y}\right)^6} + \left(\frac{i s}{Y}\right)^3} - i s \\
 &= 1.75 \sqrt[3]{\frac{1}{1 + \frac{1}{2} \times 1.75 \left(\frac{.000025 \times 70,000}{1.75}\right)^6} + \left(\frac{.000025 \times 70,000}{1.75}\right)^3} \\
 &\quad - .000025 \times 70,000 \\
 &= 1.75 \sqrt[3]{\frac{1}{1 + 35 \times 1} + 1} - 1.75 \\
 &= 1.75 \sqrt[3]{\frac{1}{1.35} + 1} - 1.75 = 1.75 \sqrt[3]{.74 + 1} - 1.75 \\
 &= 1.75 \sqrt[3]{1.74} - 1.75
 \end{aligned}$$

$$\text{Log. } 1.74 = 0.2405492 \div 3 = 0.0801831 = 1.2$$

$$\therefore y = 1.75 \times 1.2 - 1.75 = 2.1 - 1.75 = 0.35 \text{ feet.} \quad \text{Height of backwater at Robey Street Junction.}$$

2.—Funk's Formula.

$$\begin{aligned}
 y &= 2 Y - \left\{ i s + \sqrt{Y \left(Y - \frac{1}{2} i s \right)} \right\} \\
 &= 2 \times 1.75 - \left\{ .000025 \times 70,000 + \sqrt{1.75 \left(1.75 - \frac{1}{2} .000025 \times 70,000 \right)} \right\} \\
 &= 3.5 - \left\{ 1.75 + \sqrt{1.75 (1.75 - 5 \times 1.75)} \right\} \\
 &= 3.5 - \left\{ 1.75 + \sqrt{1.75 (1.75 - .875)} \right\} \\
 &= 3.5 - \left\{ 1.75 + \sqrt{1.75 + .875} \right\} \\
 &= 3.5 - \left\{ 1.75 + \sqrt{1.53125} \right\} \\
 &= 3.5 - (1.75 + 1.25) \\
 &= 3.5 - 3 \\
 &= 0.5 \text{ feet.} \quad \text{Elevation of backwater at Robey St. junction.}
 \end{aligned}$$